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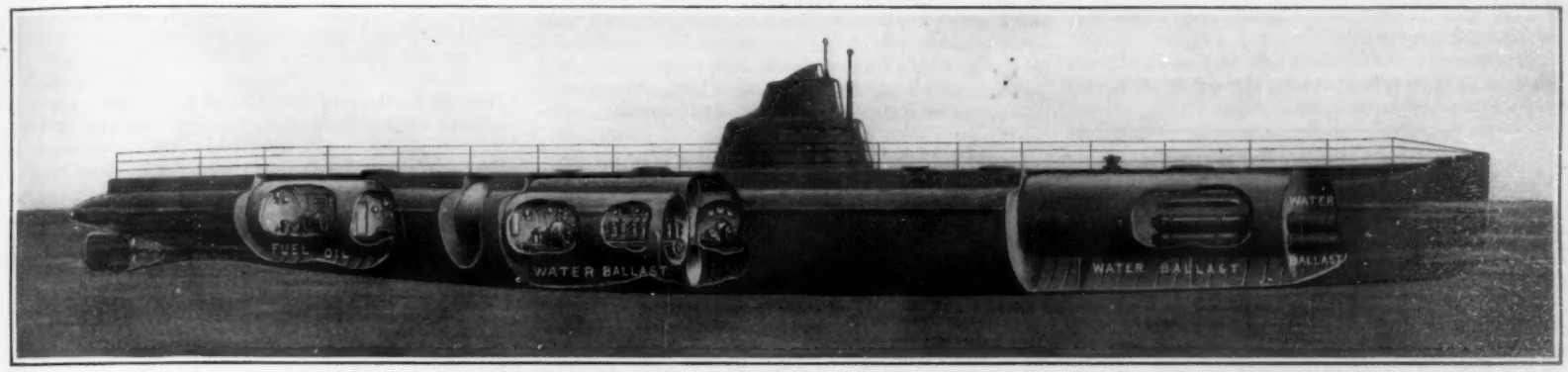


Displacement, surface, 1,200 tons, submerged, 1,595 tons; *length*, 229½ ft., beam, 27 ft. 11 in.; *horse-power*, 7,400, *speed*, surface, 23 knots, submerged, 8¾ knots; *radius*, at 23 knots, 2,000 miles; at 16 knots, 3,200 miles

Design for a Multi-Tubular Submarine

The "Multi-Tubular" Submarine

By Edwin Cerio, Naval Architect

SINCE the days of the coastal and harbor defense submarines the construction of undersea craft has made long strides towards sea-going qualities. But it cannot yet be said that the efforts of naval constructors, in this direction, have produced a final model of submarines combining high offensive power, seaworthiness and the flexibility and maneuvering qualities which are of paramount importance for independent action on the high seas.

The first steps towards seaworthiness and increased safety were made by developing the original submarines into the present-day submersible. The features of the latter type are derived, mainly, from changes in the hull construction. The outside non-water-tight shell, containing water-ballast and fuel tanks; ship-shaped forms and increased freeboard, the addition of a weather deck, are all characteristics which combine to make submarines more efficient as an offensive weapon. But the structural features of the present-day torpedo diving boats are not sufficient to meet all the requirements of a craft the finality of which has been shifted, from mere coast defense, to independent action at long distances from naval basis and which, in the present war, have proved so efficient as destroyers of line-of-battleships and ocean-going traders.

With the advent of large tonnage the structural features of submarines have undergone no basic changes: the 1,000-tonner of today is but an enlarged specimen of the 100- or 200-ton boat of ten years ago and the degree of safety attained in modern vessels is scarcely larger than that of the oldest types. In submarine hulls, of course, it has not been possible to adopt in its full completeness the ordinary system of water-tight compartments and transverse bulkheads of the surface-going vessels. The limitations of space and the high pressures which have to be withstood under water, require, in submarines, a *longitudinal* subdivision of the inner or water-tight hull.

A type designed lately to attain this end, is the "multi-tubular" diving boat, of which we present several illustrations. These drawings are taken from a recent design and from plans of a sea-going submersible having the following characteristics:

Surface displacement	1,200 tons
Submerged	1,595 tons
Length over all	229 ft. 6 in.
Maximum breadth	27 ft. 10 11-16 in.
Draught in surface full-load condition	13ft. 1½ in.
Surface speed	23 knots
Submerged speed	8¾ knots
Radius of action at 23 knots	2,000 miles
Radius of action at 18 knots	2,900 miles
Radius of action at 16 knots	3,200 miles

The boat is propelled by two oil motors fitted in the central lateral hulls, aggregating 4,200 horse-power, and two oil motors aft, in the central tubular hull, of 3,200 horse-power together, having thus a total of 7,400 horse-power for surface navigation. The electric motor plant for submerged navigation aggregates 1,200 horse-power.

No striking features differentiate the existing types of submarines and submersibles.

Among the former, the Vickers Model of 1908 (British submarines D-1 and D-2) were considered at that time as a compromise between submarines and submersibles, owing to the hipped hull. But the strange appendixes cannot be said to improve the hull lines and seaworthiness. Among the rare attempts to modify and improve hull construction that of C. L. Burger can be mentioned: his design, submitted to Congress in 1910 and a 6-ton model built for experimental purposes were intended to produce a crossbreed between submarines and surface torpedo boats, and consisted of an ordinary torpedo-boat shell with an under-water attachment shaped as a submarine and designed to contain the motor plant and torpedo armament. But the result was an incongruous hybrid, characterized by the defective qualities of the parent genuses: the visibility of the torpedo boat and the speed limitations of the submarine.

With these two exceptions—the Vickers hipped-hull boat and the Burger half-submarine—the rule which has prevailed during all the progress of undersea craft construction has been to concentrate all equipment and vital organs of the vessel in one tubular longitudinal water-tight hull.

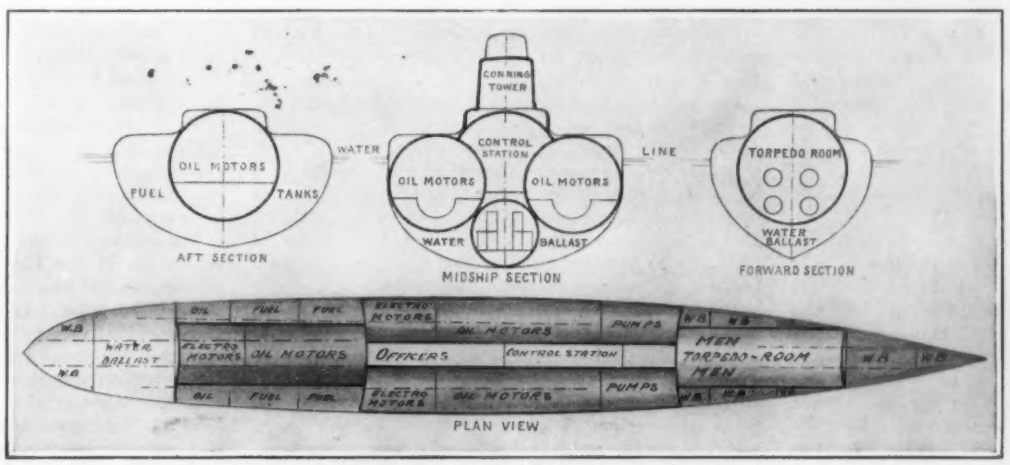
As opposed to this basic feature, the essence of the multi-tubular system consists of an assemblage of water-tight tubular chambers or inner hulls enclosed in a shell of the ordinary torpedo boat pattern. The space between the tubes within the shell in a hull of multi-tubular construction is utilized, so far as is convenient and practicable, for water ballast and fuel tanks. All the vital parts of the equipment are separately enclosed in the inner tubular hulls.

Our drawings show the general arrangement of a submersible designed on the multi-tubular system, a section amidships, and sections of the vessel aft and forward. Two central tubes and one tube of smaller diameter, below, extend for about half the ship's length amidships. Fore and aft two hulls of greater diameter are carried so far as the fining of the ship's ends allows.

The distribution of the vital organs and other equipment is shown in the sectional longitudinal view.

This construction gives a perfectly independent and separated watertight inner hull, for the means of propulsion and armament, an arrangement which contributes not only to the total safety of the craft, but also to the partial invulnerability of each of the single vital organs, preserving also the crew in case one of the hulls is flooded.

The lower hull, amidships, is used to hold the storage batteries. The forward tubular hull contains the torpedo armament and has accommodation for the crew. The space between the two hulls, amidships, is fitted to accommodate officers and petty officers. Under the conning tower is the room used as a central control station.



Plan view and cross-sections of 1,200-ton, 30 knot submarine

The Salton Sea

THE Department of Botanical Research of the Carnegie Institution has been making studies on the recession phenomena of the Salton Sea continuously since 1906. About half of the original depth of 84 feet has now been lost by the excess of evaporation and seepage over inflow and underflow, while the yearly rate of fall has been reduced from over 50 inches to less than 40. During the winter of 1915–16, the loss was less than the amount received from rains and the overflow or irrigation systems, so that the lake instead of steadily falling has now an oscillating level. The original volume of water amounted to three or four cubic miles, and its reduction by about one-half has been accompanied by a concentration of dissolved salts from about 0.33 per cent to 1.6 per cent.

Commercial Science in a Canadian University

THE University of British Columbia, situated at Vancouver, is about to establish a department of "advanced commercial science." It is to cover four years and include a degree. The subjects taught will include modern languages useful in business (Russian and Spanish are mentioned), economics, statistics, markets, financial management, foreign exchange, insurance, banking problems, etc.

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The object of this journal is to record accurately and lucidly the latest scientific, mechanical and industrial news of the day. As a weekly journal, it is in a position to announce interesting developments before they are published elsewhere.

The Editor is glad to have submitted to him timely articles suitable for these columns, especially when such articles are accompanied by photographs.

Sea-Raider Versus Submarine

As a means for destroying commerce the sea-raider, whether in the form of a naval cruiser or a converted merchant ship, is the most destructive type that can be employed—far more so than the submarine. This has been proved over and over again during the war; and we have only to recall the exploits of the "Emden" to realize that the complete crippling of overseas commerce, which the German submarines are finding it so difficult to accomplish, could be achieved by two or three dozen fast and powerful armed sea-raiders in very short order.

The sea-raider is strong where the submarine is weak, namely, in its absolute independence of any fixed base for replenishment of its stores of food and fuel. In the case where submarines are operating at great distances from their bases, which is the condition obtaining in the present deep-sea attack on the British and French coasts, it is possible that the efficiency of the submarines, due to their having to spend so much of their time in proceeding from their home base to the scene of their depredations and in returning for replenishment of their fuel tanks, is reduced fully 50 per cent. Furthermore, because of its limited supply of torpedoes and of gun ammunition, the submarine cannot make as free a use of these as it would sometimes wish.

Now the sea-raider is under no such serious limitations. Because of her size she can fill up with large reserves of ammunition, sufficient to last for fully a year's cruise, if need be; for we must remember that in the case of the majority of her captures, a blank cartridge, or a single shot across the bows is sufficient to cause the enemy merchant ship to heave to. Also, and this is what gives the sea-raider such a great advantage over the submarine, she finds a new base of supplies whenever she makes a capture; for coal can be transferred from the enemy coal bunkers, and, if the prize happens to be a collier, sufficient can be taken aboard at one recoaling for many thousand miles of cruising. As for the question of food supplies, this on its very face is the last problem to cause the captain of a sea-raider any anxiety.

To make sure of a large number of captures in a given time and to evade the fast cruisers of the enemy, it is desirable and indeed imperative, that the raider should be a ship of good speed, the higher the better; and it is questionable, if we except the new "Bismarck," sister to the "Vaterland," and the "Imperator," if Germany has remaining a sufficient number of large and fast merchant cruisers suitable for carrying on surface raiding on the same scale as the under-sea raiding by submarines. We do know, however, that Germany has been building quite a considerable tonnage of large and fairly fast merchant ships, and it is conceivable that she may have planned to make a sortie with her battle fleet in full force, with the idea of breaking open the way through the British blockade for the escape of a fleet of sea-raiders, trusting to the excitement and confusion of a great running fight to enable them to make a dash inside the four-mile limit on the west coast of Norway and get away by night into the open. If the enemy should succeed in getting a dozen such ships out on to the high seas they could do as much mischief in a given time as all the German submarines put together.

Germany, of course, possesses in her light cruisers of 25 to 30 knots speed, of which probably she has about twelve at the present time in commission, a class of vessels that would be even more effective than fast converted merchant ships. If her ruthless submarine attack is a measure of desperation, it is surprising that she has not attempted to get a few of these craft out before this. Should she make the attempt and succeed, her dream of paralyzing the activities of the Allies would be brought to the verge of speedy accomplishment.

Against such an attempt at wholesale sea-raiding our armored cruiser fleet would be most efficient. They are 22½-knot ships and carry heavy armaments of 10-, 8- and 6-inch guns, sufficient to make short work of any batteries mounted by German light cruisers or converted merchantmen. Obviously, the most effective way to use these ships against a concerted raid of this kind, would be to meet and break it up before it could get clear of the North Sea. This suggests the thought that perhaps these vessels would be more effective if they were to have their base in some harbor on the North Sea coast of Scotland, rather than on this side of the Atlantic.

But what if the Germans succeeded in getting their five 28 to 30-knot battle cruisers out into the Atlantic, and started them raiding on the great sea-routes of that ocean and the Mediterranean? This would be a problem, indeed! We have nothing that could catch them, and it is doubtful if Admiral Beatty would care to detach his own battle-cruisers from the North Sea fleet. Possibly the task of running them down would be allotted to the Japanese battle-cruiser squadron, which comprises the four fine ships of the "Kongo" class which are armed with 14-inch guns and have a speed of 28 knots.

American Invention in the War

A NATION of inventors, we are alike a peaceful nation and peaceful inventors. We are by nature inclined to turn our energies to making the world a better and an easier place to live in, rather than to elaborating instruments of death and destruction. The cotton gin, the reaper and its many descendants, the sewing machine, the telegraph, the telephone, the typewriter, the typesetting machine, the web press, the motor truck and the tractor—these are but a few examples which come to mind. And even in seizing upon and developing the inventions of others, we show the same peaceful tendency. Steam locomotives, electric transportation, automobiles, machine tools, the wireless telephone, are just an indication of the sort of field in which we ordinarily try to beat the European at his own game.

And yet we are quite capable of turning our inventive genius into less benevolent channels, of putting it at the disposal of those who make war. The submarine which is causing such annoyance to our allies is our invention; so is the torpedo with which it accomplishes its deadly business. We are equally responsible for the machine guns which make open fighting and assault such bloody work, and for the barbed wire upon which our German friends make a point of receiving Tommy Atkins and the poilu when they call at his trenches. The aeroplane which has so eliminated surprise in warfare that it is today possible for the veriest ingenue in military affairs to look with laughing condescension upon the spectacle of Napoleon, defeated at Waterloo because he was in ignorance of important troop movements a few miles away—this too, is ours. Devices so radically opposed in their aims as the explosive projectile and the armored ship owe their origin and much of their development to the American mind.

On the whole, then, it appears not only that American inventive genius can claim its share of the doubtful credit for the frightful character which twentieth century warfare has assumed, but that when it does turn its efforts to such things it is quite as efficient in them as in its more accustomed field of benevolent activity. Under the circumstances, then, it is not at all out of place to look to American invention to do its bit toward bringing the war to a successful conclusion.

No man can say just where opportunity to do this may be found. It is at least within the range of imagination to picture some new and fearful application of the wireless principle—some means for making electricity accomplish, from a distance and without wires, a tithe of the destruction of which it is now capable under standard conditions—which will make further resistance shrivel into nothing. Or, in default of this, we are always privileged to picture the coming of some other instrument of long range annihilation which shall admit of no rebuttal. But the probability of such an outcome is of course negligible. Rather we may expect American invention to settle the war, if at all, by what Steinitz, world's champion chess player, used to call "an accumulation of minor advantages." If we can make our guns and those of our allies range a little farther than those of the Germans; if we can make our projectiles a little deadlier, and our ranging apparatus a little more certain; if we can make our aeroplane a trifle superior in speed, armament and general efficiency; if we can make our ships a bit faster and a bit more formidable in gun-fire; if, in short, we can make the equipment of the forces fighting the Germans just a little better, in every essential feature and in every department where results that count are obtained, than that of the Prussian hosts—then indeed the victory is infallibly ours.

We have no hesitation, then, in issuing an emergency call to the inventors of America. If each one of this large and capable body will contribute his mite to the general superiority, the war will be over soon. Without such contributions we may ultimately win the war; but without them we cannot possibly win it this year, or within any reasonable time. Accordingly let every American inventor look into that fraction of the field of science with which he is best acquainted, seeking what he can find there which will have bearing upon effective conduct of the war, on the fighting line or behind it. And when he has found something, let him put it in the way of being used to its utmost possibilities in bringing this conflict to a close.

Saving the Heat Lost in Internal Combustion Motors

IN spite of the high thermic yield of internal combustion motors, a very large proportion of the heat furnished by the fuel is carried off either in the escape gases or in the cooling water of the cylinder's jacket. It is authoritatively stated, in fact, that no less than seventy per cent of the heat is thus wasted, the amount being pretty equally divided between the water and the gas. The increasing popularity of late years of this type of motor has led engineers to seek to recover some portion of this immense wastage of heat. The simplest method is to use the hot water issuing from the cylinder's jacket for the production of steam feeding a turbine or a piston engine. Unfortunately, however, the temperature of the water thus evacuated is relatively low, *i. e.*, about 70° C., or 158° F. The reason for this is that experience has shown that if the temperature rises above this point the cylinder promptly begins to seize. Therefore, the evacuated water must be fed into a boiler so that the steam may acquire sufficient pressure to be economically used. Obviously, therefore, it is desirable to find a method by which the cylinder may be prevented from seizing, while at the same time the water in the jacket may be allowed to rise in temperature sufficiently to furnish steam directly under a pressure of several atmospheres. Such a result would have the further advantage of augmenting the thermic yield of the motor, since this increases in the same degree as the temperature of the gases in the cylinder, and this temperature will naturally be higher if the walls of the cylinder are hotter.

Engineers, therefore, have devoted much study to methods of preventing seizing while the temperature of the walls is above 100° C., or 212° F., *i. e.*, the boiling point of water.

An admirable device for this object has been proposed by a Mr. Merriam in a late number of the *Revue Electrique*. This plan, which is pleasingly simple is based on the observation that when water is heated in an iron pot to a temperature above 65° C. small bubbles of steam are seen to form and adhere to the sides of the pot, increasing as the temperature rises, until they completely cover the inner surface of the pot, and then tend to prevent the passage of heat from the exterior fire to the water contained in the receptacle.

Mr. Merriam's idea is that the cylinder of an internal combustion motor, cooled by the exterior circulation of water, seizes when the temperature rises above 70° C. because there has been formed between the surface of the cylinder and the water a layer of gaseous bubbles which is thermically isolating and therefore, interferes with the cooling of the cylinder and hence causes it to rise in temperature to a point beyond that at which lubricating oil is resistant.

The solution of the problem, therefore, rests in the prevention of the formation of the gaseous bubbles. In the iron pot this can be done more or less well by stirring the water. In the motor the same result can be secured by giving the water a very great rapidity of movement, that is, a speed five to ten times as great as is usual.

In the tests carried out by Mr. Merriam water taken from a boiler passes into the water jacket of the motor, then returns to the boiler. In these conditions the pressure can be raised to 3.5 kilograms per square centimeter, which corresponds to a temperature of about 140° C. All the water is thus transformed into steam, and in this form we regain the total amount of the heat which is ordinarily lost in the water of the jacket.

With a boiler conveniently installed, furthermore, the 35 per cent of caloric carried off by the escape gases can be utilized, and adding to this the 35 per cent recuperated in the water of the water-jacket, we regain, in the form of steam at a low or medium pressure, about half the heat contained in the combustible.

At the same time the functioning of the motor is improved because of the higher temperature of the cylinder. Thus, at full load, the consumption of gas, in cubic meters per horse-power hour, falls from 0.269 to 0.260, equivalent to a reduction of 3.3 per cent; at a quarter load it passes from 0.493 to 0.409, realizing an economy of 17 per cent.

Mr. Merriam states that during the practical tests of this process made by him there was no difficulty or ill results observed even when the motor was functioning at the maximum temperature and pressure. It seems probable, therefore, that the method will be widely adopted.

Electricity

A Pilot Lamp for Electrical Appliances has recently been introduced on the market in the form of a two-candlepower bulb mounted in a brass case which is essentially an attachment plug. The bulb is connected in parallel with the device for which it is to act as a pilot lamp, so that the instant the device is energized the bulb glows.

The National Electric Safety Code.—The Bureau of Standards reports that 1,000 copies of this code, which was prepared by the Bureau in cooperation with leading electrical engineers and representatives of light and power companies, electric railways, telephone and telegraph companies, and electrical manufacturers, have been distributed to collaborators, public commissions and officials, while nearly 10,000 copies have been sold. Many companies have already adopted the code in their establishments. The Bureau is preparing a supplementary publication dealing with the scope and application of the code.

American Electrical Goods in Porto Rico.—Opportunity for American manufacturers of electrical equipment to sell substantial quantities of goods in Porto Rico will be afforded soon, as a result of the prosperity that has come to the sugar industry in the island after many years of unsatisfactory business. A report on the Porto Rico market for electrical goods has been issued by the Bureau of Foreign and Domestic Commerce, and the prediction is made that when past losses have been recouped to some extent, considerable capital may be available for modernizing the sugar mills, and electrical installations will have their important part in the work that will be undertaken. The report calls attention to the fact that the only sources of business in electrical material in any volume are the electrifications of the sugar mills, the erection of lighting plants in the towns not now provided with them, and lighting in general, both public and private. The new bulletin is taken up largely with descriptions of power plants, lighting, industrial power, telephone and telegraph systems, steam and electric railways, and miscellaneous apparatus, and advice as to the prospects for selling equipment.

Electrical Conduit in New Zealand.—Jobbers and importers in New Zealand have experienced difficulties recently in obtaining enough electrical conduit to meet their needs from the usual sources in England. They are interested in American sources of supply and have asked about the possibility of manufacturers in the United States making conduits in accordance with the local standards, with the object of meeting the demands of this market. Brazed or welded heavy-gage conduit is commonly used, made up with screwed, or as the New Zealanders term it, threaded joints. The North Island has a wider use for the brazed joint, while in the South Island the welded is most popular. There is also some use of the open joint with slip or grip fittings. As the conduit used in New Zealand is of lighter weight than that used in the United States, a finer thread is employed. Rating is by the external diameter, and not internal, as in the American trade. The ⅝-inch has the most extensive use, as the small over-all diameter of English rubber-covered wire makes a ⅝-inch measurement satisfactory for small installations. An American company is now furnishing some dies to a local jobber to cut these threads, so that there should be no difficulty in obtaining the proper tools for this purpose.

Electricity to Prevent Pipes from Freezing.—In a recent issue of the *Electrical World* a novel method of preventing pipes from freezing is described. At one of the hydro-electric plants of a Portland, Maine, light and power company, cooling water for the main transformer is piped from the wheel casings in the generating station across the tailrace to a transformer house. The piping is housed in a wooden casing covered with tarred felt, but the outdoor location exposes it to severe weather. To prevent freezing, 32-candlepower carbon lamps were installed with the duct about two feet apart, with their axes placed horizontally. When surges occurred on the transmission lines of the system, however, trouble was experienced from burning out the lamps. To secure more reliable service, L. G. Scott, head of the underground-distribution department, designed a simple but effective heating unit of No. 13 gage iron wire. Each unit was made by winding a wire closely on a ½-inch pipe. The turns were then slightly spread apart and the ends of the helix, which is about 15 inches long, are held in porcelain cleats. The units are installed two feet to three feet apart, each being provided with a semi-cylindrical galvanized-iron reflector which serves to reduce the radiation and, by maintaining a high coil temperature, cut down the energy consumption. Twenty-four units are run in series from a 110-volt or 220-volt supply, according to the severity of the weather. At 220 volts the series of resistors draws 20 amperes. The diameter of the wooden duct is about twelve inches square in cross-section, while the diameter of the circulating-water pipe is 2½ inches.

Science

An Institute for the History of Science.—An elaborate scheme set forth in *Science* by Dr. George Sarton, of Harvard University, contemplates the establishment at some suitable place in this country of an institute devoted to the study of the history of science. A large number of prominent scientific men have promised their coöperation in the project, and two or three fine libraries on the history of science and of its special branches will probably be given to the institute, if established.

American Digitalis.—The pharmacopœial species of digitalis, *D. purpurea*, grows wild in great abundance in this country, as an escape from cultivation; especially in the far West and in West Virginia. In view of the high price of digitalis, heretofore supplied chiefly from Germany and Austria, the U. S. Public Health Service has been investigating the possibility of turning the American plant to account. Tinctures prepared from several specimens of air-dried leaves of wild plants from Washington and Oregon resulted in a highly active product, comparing favorably with that obtained from cultivated plants dried by special methods.

Improvements in Bronze Statuary. At the suggestion of the art commissions of the cities of New York, Philadelphia and Detroit, as well as certain art-bronze manufacturers, the U. S. Bureau of Standards is planning to take up the question of standardizing art bronzes for outdoor statuary. The program includes a determination of the most suitable chemical composition, the production of an attractive patina, and methods of care and cleaning of statues. The unsightly appearance of many out-of-door bronze statues, due largely to the polluted atmosphere of our towns, is a matter of common observation, and the subject is well worth investigation.

New North American Birds.—In a recent lecture, Mr. H. C. Oberholser, of the U. S. National Museum, called attention to the many additions made to the list of North American birds during the period 1910-1916. These included fully 125 species and subspecies. Most of the additions resulted from the description of new subspecies, or the revival of hitherto unrecognized form, among the most interesting being five new subspecies from Newfoundland. Two distinct species were described from North America during this time; viz., *Aestrelata cahow*, from Bermuda, and *Larus Thayeri*, a remarkable new gull from Ellsmere Land. Among the most interesting extralimital forms found for the first time within our boundaries during the same period were *Puffins carneipes*, taken in California; *Pœcilonetta bahamensis*, found in Florida; *Petrochelidon fulva pallida*, in Texas, and *Tryannus melancholicus satrapa*, in Maine.

Duration of Leaves in Evergreens.—Some interesting studies of this subject have been made by Miss Vinnie A. Pease in the Pacific northwest, which is peculiarly an evergreen region. It was found that leaf duration varies widely, both among different species and among individuals of the same species. The shortest duration is found in *Rhamnus purshiana* which is a quasi-deciduous plant, shedding part of its leaves in the autumn, but retaining some until those of the next season are mature. The longest duration is noted in *Taxus brevifolia*, in which some leaves have persisted for 23 years, though the average is from five to twelve years. Saplings of evergreen trees have a shorter leaf duration than mature trees in the same habitat. Trees and shrubs growing in the open have a shorter leaf duration than those of similar age in the shade. Trees or shrubs on a windward coast have a shorter leaf duration than those on a leeward coast. Gymnosperms in a moist climate have a shorter leaf duration than those in a drier climate. A peat bog habitat has an effect similar to a dry climate. Several other factors enter into the problem.

Injury to Plants by Illuminating Gas.—At the instance of the Berlin gas works, investigations have been made in the parks of that city upon the damage done to plants by illuminating gas. In all plants suffering with gas poisoning it was noted that the chlorophyll was attacked, and disappeared little by little. In spite of the presence of all factors for growth, the process of assimilation and the formation of new organic substances were impeded in the plant when the soil was permeated with gas. The phenomena indicated the occurrence of asphyxia through the want of oxygen in the roots. The first visible effect above ground is a drying of the edges of leaves and other green parts. This reduces transpiration and leads to an excessive accumulation of water in the lower parts of the stalks and roots. The result is often wet rot and death of the base of the stalk. Rapidly spreading transparent spots on the leaves are a symptom of gas poisoning in many large-leaved plants. In rapidly growing plants, such as fuchsia, begonia and azalea, the falling of leaves is a symptom. In Taxus and some other trees big lenticular swellings occur in the roots, in consequence of excessive water supply.

Invention

Shining Shoes Without Soiling One's Hands is made possible by the invention of Theodore F. Gensmer of Minneapolis, Minn., who has perfected a shoe-shining device that operates on the fountain-pen principle. The device consists of a hollow handle adapted to contain a suitable paste, a brush member through the center of which extends a tube connected with the paste reservoir, so that the paste may be brought to the shoe surface, and a pump-like means of forcing the paste out of the hollow handle.

A Butter Dispensing Apparatus for Restaurants which has just been invented by a New Yorker, Nicklaus Kavgas, should prove a boon to the restaurateurs who are now obliged to watch the dispensing of butter with ever-increasing vigilance. The butter dispensing machine consists of a chamber in which are located a plurality of containers, each having an inlet and outlet for the reception and discharge of the butter. Cutting members are so arranged that, when manually operated, they slice a piece of butter of predetermined size which is discharged from one of the containers, each container being operated separately.

Extracting a Broken Set Screw.—One of the most serious aggravations of the machine shop is a broken set screw, the removal of which is a tedious operation to be taken care of at once to the sacrifice of all else. Matters of this kind are now performed expeditiously by means of an extracting tool which has been designed for the purpose. It resembles a drill with a coarse left-handed thread, and to remove a broken set screw, cap screw, stay bolt or stud, a hole is drilled in the remaining portion into which the extractor is slipped. As it is turned it exerts a reverse influence on the broken set screw and the latter is backed out on its own thread. The new tools are made in three different sizes covering practically all machine shop requirements. They are sold in sets.

An Engine for the Old Hand Car.—What is known as a "power top" is a gas engine outfit by means of which a hand car, such as is used by railroad laborers to get to and from moderately remote points along the line, may be transformed into a motor-propelled vehicle not only capable of carrying a crew of eight men, but also drawing another car loaded with material and supplies. The power plant is enclosed in a frame, the top of which provides seats for the crew and is in convenient shape to be installed readily on any old hand car with very little alteration to the old equipment. The engine is movable on the sub-base plate and it is thrown into and out of gear by means of a lever which shifts the motor slightly so as to change the tension of the driving belt. The motor is driven by kerosene fuel and is rated for a speed of 15 miles an hour in either direction.

An Adjustable Electrolier.—A patent has recently been granted to H. D. McFaddin of East Orange, N. J., on an adjustable electrolier for semi-indirect lighting. Heretofore the supporting rods or spacing members have usually been rigid and of a definite length, so that it has been difficult to fit a globe or shade to the fixture. In the present electrolier, however, the inventor makes use of extensible rods for the chain members. These rods are in the form of two units, one unit being attached to the shade-engaging member and the other unit to the lamp-supporting member. The units are adapted to overlap one another, and each unit is provided at its free ends with a hook-shaped tongue to engage with one of several apertures or slots in the other unit. No tools are required in adjusting the connection. Furthermore, if a fixture is installed for a lamp of a given size and it is subsequently desired to use a different form of lamp, the change can be permitted by a simple adjustment of the shade-supporting members. A cardinal feature of this electrolier is that the rod members always appear as if they had been made for the fixed adjustment in use at any given time.

A Noiseless and Shockless Car Track Intersection.—The problem of suppressing the noise and shock of the street car in passing over an intersection has been attacked in a novel manner by a Philadelphia, Pa., inventor, Samuel B. Meeker, who accomplishes the object without the use of any of the moving and interlocking parts which characterize most of the inventions for this purpose, and without making any great changes in the design of the crossing itself. The latter is constructed in one piece or unit, and at a point slightly in advance of the intersection of the rail sections. Each rail section is formed with the face of the rail cut away in an incline which allows the weight of the vehicle to pass from the base of the wheel to the flange on which it continues for a few feet, until the wheels have passed entirely over the intersection, when the weight of the car again passes to the base of the wheel. This change is so gradually accomplished that it is not noticeable to the passengers and the car passes over the crossing without jolt or noise. The latter is a matter of great importance to persons living in the vicinity of such intersections, for the pounding of the cars over them at night comprises a serious annoyance.

The Hudson Bay Railroad

How Canada Will Eliminate the Railroad Haul Across Half the Continent

By Earle William Gage

THE nations of the earth bordering on the northern seas seem determined to defeat one another in reaching these waters. While Russia is straining every muscle in her effort to complete the railroad between Petrograd and the Arctic Sea, and the United States Government is exercising every practical means in finishing her 504 miles of Alaskan railway, Canada, not to be outdone by nations older in commercial development, is completing, this spring, her most recent commercial project of connecting her three trans-continental railroad systems with Hudson Bay.

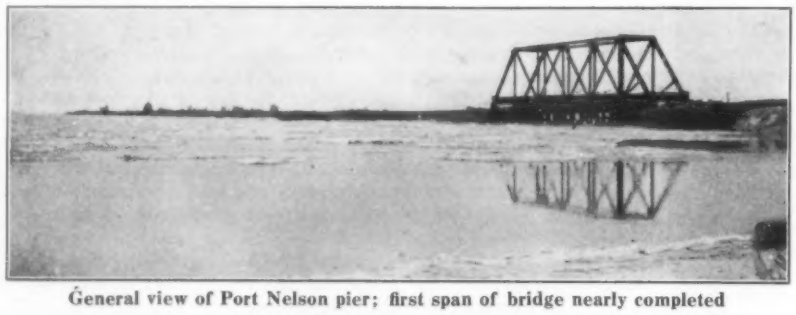
That the completion of the Hudson Bay Railroad is a vital matter of interest to American commerce, needs no argument. It is not the idle dream of a passenger agent desiring a new field of tourist endeavor, but the result of insistent demands made by a country whose development has outstripped the efforts of three great railway systems to keep pace. As early as 1906, Western Canada was the congested center of railway transportation, both outgoing and incoming lines being blocked with grain, live stock and supplies. The Hudson Bay Railroad is simply the result of a continuous blockade of traffic, the aim being to relieve this by giving the shortest possible route to tide water from fields of production.

Had not an enlarged outlet been supplied to the ocean, the development of Canada would have been retarded. Canada's great inland sea, Hudson Bay, gives the West tidewater in the meridian of the Mississippi Valley. A glance at the map shows it to be the shortest route from the center of the country's fields of production to the world's markets. Port Nelson, the northern terminus of the new railroad, is as near the central point of the grain area as the center of that area is to the head of the Great Lakes, and it is about the same distance from Liverpool as Montreal.

When the engineers of the Canadian Northern Railway drove the last spike at The Pas, they had forged the first link in the new commercial chain. This was the initial effort to reach Hudson Bay. In 1908 the Department of Railways and Canals of the Dominion Government sent Engineer John Armstrong, an experienced railway surveyor, with a staff of four parties, to make the purposed survey map to Hudson Bay from The Pas, which is located on the River Saskatchewan. Lines were run from this point to Fort Churchill and to Port Nelson, both on Hudson Bay; contours were taken closely enough to enable a projected location to be made that assured reasonably accurate quantities, and detailed surveys were made of the harbors of both points on the bay, as well as at all important river crossings. As Port Nelson promised the most accessible port for commercial purposes, with exceptionally favorable terminal grounds and pier foundations, it was selected as most favorable. While it would have been 480 miles to Fort Churchill, the line as laid down will be but 425 miles long. Moreover, it passes through a country rich in natural resources, and affords a much more reasonable location for a roadbed, with the fewest possible excavations.

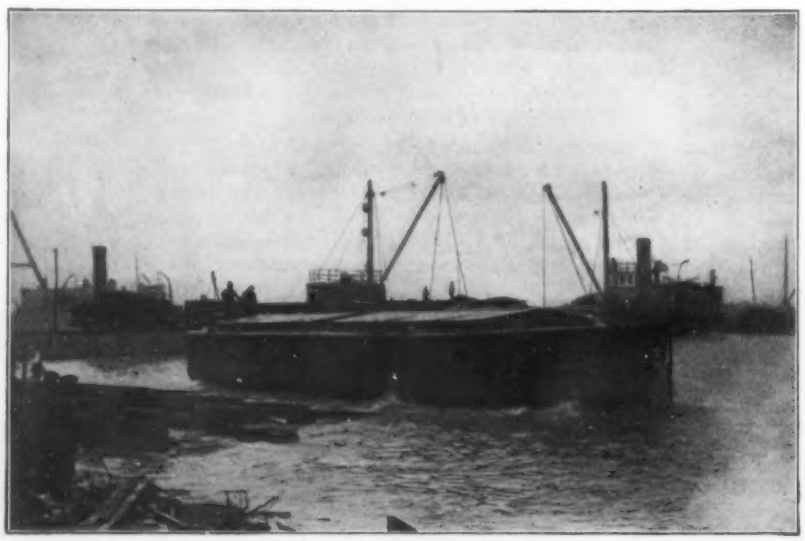
In fact, the first section of approximately 120 miles is through a comparatively level or smooth country, affording easy grades and cheap construction. The stream crossings are very light, with the exception of the River Saskatchewan. The second section of 120 miles is through a granite country, demanding rock-cutting in roadbed construction. One large bridge has been constructed across the Nelson River at Manitou Rapids, 1,000 feet wide, and one of 3,000 feet across the lower Nelson. Elsewhere trestles have been sufficient, except across the Frog River.

Port Nelson is located at the mouth of the Nelson River. This region is often associated with Arctic conditions; yet no part of Hudson Bay comes within the Arctic Circle, and Engineer Armstrong in his recommendations stated with considerable assurance "That ships may enter and leave Port Nelson all the year round is a fact worth remembering." The northern part of the Bay is in about the same latitude as the Highlands of Scotland, while Moose Factory, on the southern shore, is considerably north of London. Port Nelson is south of Riga, Russia's great seaport, on the Baltic, and Fort Churchill on about the same parallel as Stockholm. The temperature of the water of the Bay is several degrees higher than that of Lake Superior, and in the opinion of Commander Gordon, the Bay may be regarded as a vast basin of comparatively warm water, which has a mitigating influence on the winter climate of the surrounding country.

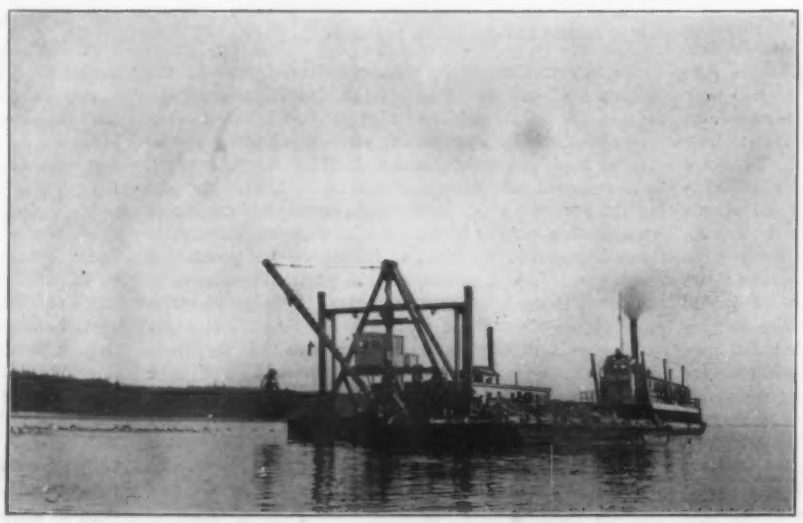


General view of Port Nelson pier; first span of bridge nearly completed

Looking toward new Hudson Bay ship channel, showing work in progress on bridge piers. In the foreground, hardwood and steel plate ice bulkheads are being placed



Steel tow barge at Port Nelson



Excavating boulders at Port Nelson from river bed to use for crib filling. Orange-peel dredge, scows and sternwheel tug were built at Port Nelson

Though the Bay remains open, Hudson Strait freezes over. Hence transportation will be possible for only three months a year, from the end of July to about the end of October. But inasmuch as this gives full time for the moving of the food products to Europe, at a very material saving in time and freight cost, the expenditure of $16,000,000 for the construction of the 425 miles of railroad, will pay big dividends to the government. During the closed season the natural resources of the Bay region, including farm crops, timber, paper-pulp, minerals, and the enormous wealth of fur and fin, will compensate for the operation of the system.

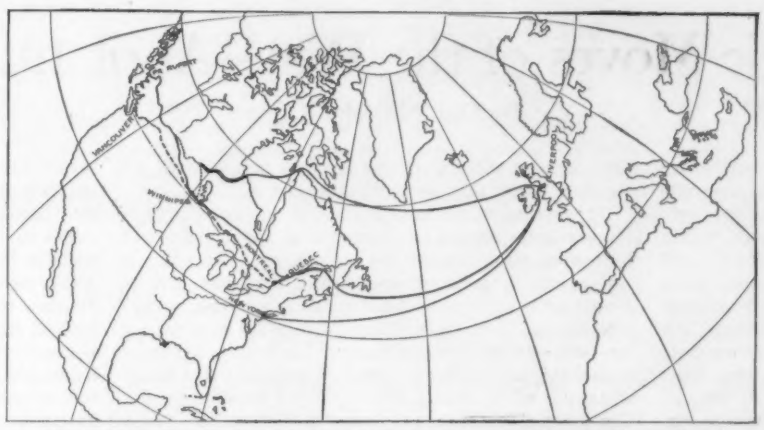
The exponents of the railroad point out that the heavy grain traffic from the western plains to the Atlantic seaboard is carried over the Great Lakes only during the summer and fall season, and that it must close with the ice-jam. This is but a little longer season than the Hudson Bay route promises, and inasmuch as the waters permit large vessels to enter to Port Nelson, larger cargoes may be carried in a shorter time, which discounts the argument against the route to Europe.

That the Hudson Bay route promises a path from Western Canada to Liverpool, shorter by 1,000 miles than the present prevailing rail route, is a powerful factor in its favor. Winnipeg, Brandon, Regina, Calgary, Prince Albert and Edmonton, the great collecting points of Western Canada, are from 1,061 to 1,296 miles nearer by shortest rail routes, to Port Nelson than to Montreal. On the other hand, from Port Nelson it is 2,925 miles to Liverpool, while from Montreal, via Belle Isle the distance is 2,761 and via Cape Race 2,927 miles. The utilization of the Hudson Bay route will effect, therefore, an average shortening of 1,000 miles to the tide water, without increasing the ocean distance to the world's markets.

That a very material saving will be effected in freight cost alone, is appreciated when we remember that the freight upon grain from the wheat belt to Hudson Bay approximates ten cents per bushel, or the same as to the head of the Great Lakes, at present. It now costs fifteen cents per bushel to transport the grain to the Atlantic seaboard ports, which represents a fair profit to the wheat growers. Assuming an export trade of 20,000,000 bushels, which could be readily handled if the harbor were open but two months of the year, this saving would amount in a single season to approximately $3,000,000.

The demand for Western Canada's prime beef, mutton, pork and poultry is increasing in Europe. It now costs about sixty cents per hundred to transport steers to the Atlantic ports, and an additional sixty cents to ship them

to Liverpool. For the payment of 60 cents per hundred these cattle and stock may be delivered in Liverpool, on an average, from the fields of production, or an average saving of $6 per head for steers. This saving will approximate $1,000,000 per season of only two months, or a total of $4,000,000. Therefore, if the Hudson Bay Railroad is operated but two out of the twelve months, in four years it would pay off its construction debt. But the officials have calculated that the remaining nine or ten months may be devoted to interest bearing operations of a local nature.



The Hudson Bay Railroad in its relation to Canada's three leading railroad systems and to the world's trade route

The Hudson Bay Railroad is shown by double lines

The Oil-Engined Yacht "Aramis"

WHEN the war broke in upon us there was completing at Jacob's Yard, City Island, the large and powerful yacht "Aramis" for her owner A. H. Marks. Promptly he offered her for government service in connection with patrol work, or any other duty for which she might be suitable.

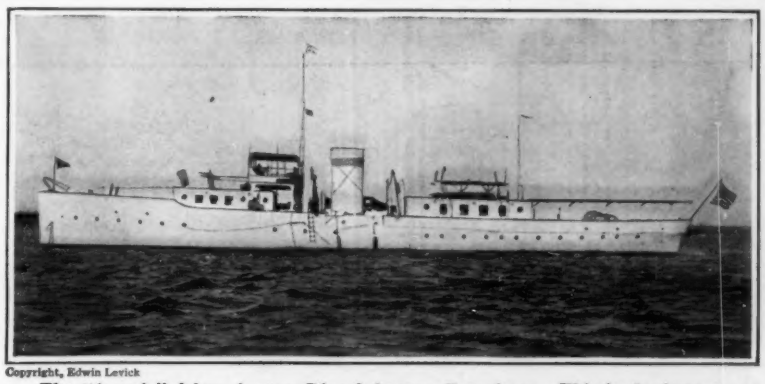
The "Aramis" is, we understand, the largest yacht driven by oil engines in existence. The hull is designed somewhat on naval lines, with a modified cruiser stern, and the rudder completely below the waterline. The dimensions are, length 157 feet; beam 22 feet; draft 10 feet 9 inches. The gross tonnage is 270 and the net tonnage 183½ tons.

The "Aramis" is driven by two Diesel, heavy-oil engines at a speed of about twenty knots. Because of her size she could carry quite a heavy armament if it were desired; but should she be employed in the submarine-swatting service she will probably mount one or more 3-inch rapid-firers, or a large number of six and three-pounders.

A novel feature in this yacht is the installation of a Sperry gyroscopic stabilizer, which has been placed, as our illustration shows, in the engine room. The stabilizer which was installed for the comfort of the owner and his guests would, of course, be very valuable in making the "Aramis" a steady gun platform. The stabilizer in the "Aramis" has the following particulars:

Weight of rotor	4100 pounds
Speed of rotor	2100 r.p.m.
Diameter of rotor	48 inches
Width of face of rotor	12 inches
Horse power necessary to run rotor	7 H. P.
Floor space required for equipment	5′2″ x 5′3″
Motor	3-ph. A. C. Induction spinning motor

This equipment, weighing about three tons, is able to hold a 250-ton boat on an even keel regardless of weather conditions. The plant consists actually of two main elements, a small auxiliary gyro and the main gyro. Before a ship can move in response to the disturbing force of a wave there is a slight lag. This time lag is utilized by means of the small gyro, which is so sensitive that it detects a roll of a fraction of a degree. The motion of the little fellow gets under way, or "precesses," the main gyro, thereby setting up counter forces which exactly balance the disturbance, or tendency to movement, of the ship due to the wave. In action, the instant there is the slightest response of the ship to the rolling action of a wave, the little control gyro detects it, and, by its movement, closes a circuit which immediately releases a brake B and starts the precession motor A, whose function it is to rotate the main gyro about its axis. This motor, by means of the worm and wheel C rotates the pinion D, which engages the large precession gear E, and thereby turns or precesses the gyro. The turning of the main gyro brings into play a force which acts directly against the force exerted by the wave. The gyro precesses slowly until the wave has passed, when the contact of the control gyro is broken and the brake immediately set, thereby preventing further precession. The control gyro is then conditioned to detect the next wave and cause the main gyro to precess in the proper direction to oppose the rolling tendency.



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The "Aramis" driven by two Diesel, heavy-oil engines. This is the largest yacht in existence driven by oil engines. It is capable of a speed of 20 knots

The Panama Canal and the Tin Smelter

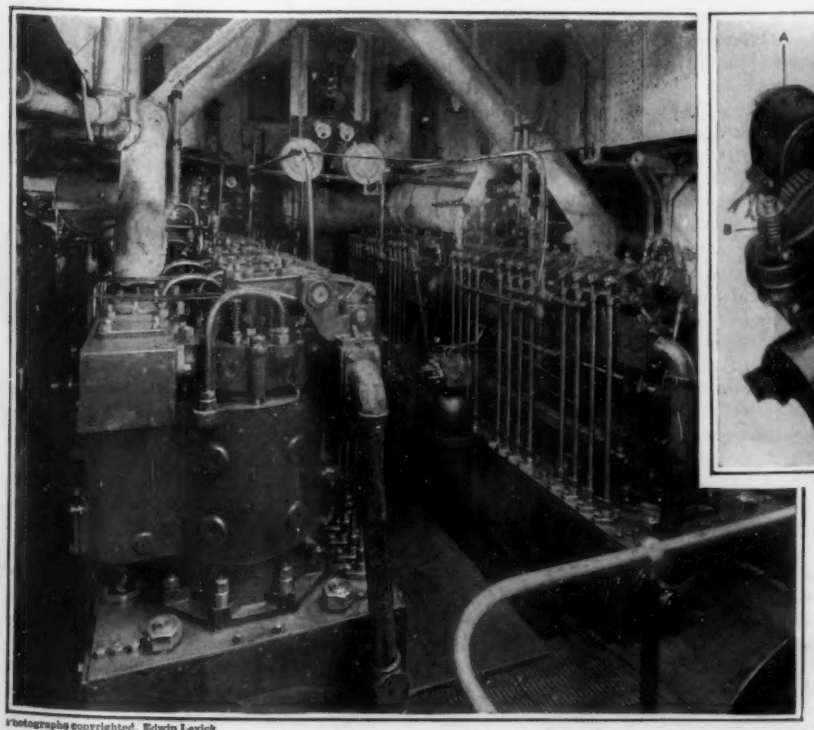
THE use of Bolivia tin in this country has always involved a long transportation of the ore around the Horn to Liverpool, or sometimes to Cornwall, from which places, after reduction, the metal has been shipped across the ocean again, mostly to New York, for American distribution. But the opening of the Panama Canal has so shortened the journey from Mollendo, Peru, and from Arica and Antofagasta, Chile—the chief ports used by land-locked Bolivia in her dealings with the outer world—that they are now less than half as far from New York than from the British smelters. Accordingly the best economy seems to demand that we bring the Bolivian ore directly here and do our own smelting; and this we are now about to do.

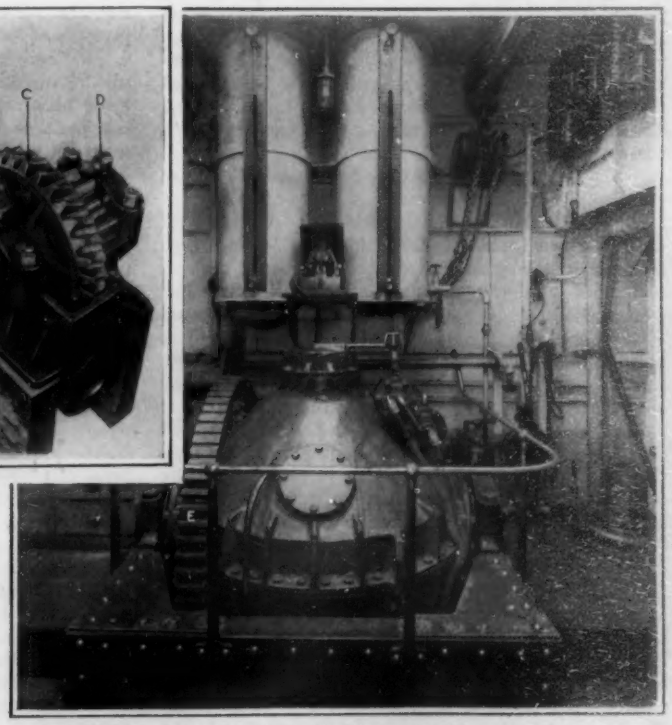
The largest European firm of tin smelters has just purchased a tract of some nine acres of land on the northern shore of Jamaica Bay, the great basin which some day is to play such a heavy role in New York's commercial development. Plans for a tin smelter on this site, which will be the largest and most modern of its kind in the world, are in preparation, and within a year this will be in actual operation. When completed and in full swing, it will have an annual output of 20,000 tons of tin.

Another factor of interest comes from the lead industry. This business constitutes one of the largest consumers of tin, the leading company alone taking ten million dollars worth per annum, for use in the manufacture of solder, type metals, babbitt metal, etc. The lead trust already has a plant in the neighborhood of the projected tin smelter, and is now about to make large additions, with a view to ultimately using on the spot as large a percentage of the smelter's output as possible. We have here an admirable illustration, not only of the way in which such undertakings as the Panama Canal affect the whole business structure of the world to our advantage, but of the lengths to which modern industry is prepared to go in its efforts to cut out the transportation factor.

The National Library of Siam

THE American vice-consul at Bangkok reports the formal reopening, by the King of Siam, of the National Library, which has just moved into new and spacious quarters. This library was established in 1881 by the children of King Mongkut, as a memorial to their father, and it was formerly called the Vajirana Library. In 1904 it became the depository for the national archives of the kingdom, and also for the religious archives and it was put under the care of an eminent orientalist as chief librarian. The library was divided into three sections; one for religious literature in the ancient Bali language, another for Thai or Siamese literature, and a third for foreign literature. Ancient manuscripts in Bali and Thai have been gathered from Buddhist monasteries throughout the country, and more than 100,000 of them have been placed in the library. From time to time selected manuscripts are published by the library, more than 100 of these having already been issued. Lastly, the National Library has an important collection of ancient inscriptions on stone.





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The Diesel engine plant of the Yacht "Aramis" and the gyroscopic stabilizer. The insert shows the precession unit of the stabilizer

Strategic Moves of the War—April 19th, 1917

By Our Military Expert

THE week has been characterized by the most severe fighting and by the greatest number of men and guns engaged that probably the world has ever seen. The movements began on April 9th when the British advancing north and south of Arras on a front of 20 miles proceeded to smash through the German lines, not only in the direction of Cambrai, toward which city all previous efforts had been in the main directed, but also toward Lens and Douai, the latter being the northern extremity, if any, of the so-called Hindenburg lines. Apparently from the manner and direction of the forward thrusts of the British commanders, it was known where the strong points of any such lines lay; if the conditions at the present writing are considered, any such lines have been badly smashed by the terrific blows of English troops, especially in the last four or five days. For the first time since the war began, the British are making quick sharp drives and more men are being employed than at any time possibly in this war's history. From the time the present advance began, the question has been constantly asked—why were not the German positions more strongly held? Perhaps it was intended by the German staff to evacuate some of them; but if so, the British advance appears to have been too quick for them. So far certainly two vital things have been shown—first, that the Allies have now the undoubted supremacy of the air—second, that resources in munitions are so great they can be used by both the French and British, irrespective of quantity or cost. The main German positions appear to have been literally pulverized by high explosive shell. The top of Vimy Ridge has been actually blown away and other positions have practically suffered the same fate. Vimy especially is reported as looking like a volcano.

Just now, while fighting is extending on the British front, all the way from Lens to St. Quentin, the principal efforts are centering around Lens where every move appears to be designed to pocket the city, as in the case of St. Quentin now also almost ready to fall. The present situation as regards the British is most remarkable; despite the German destruction of roads, bridges and all means of communication, they have continued a steady advance all along their lines, showing that they have been well backed up by their artillery. This is all the more surprising in view of such forward movements being made in the face of ice, snow and sleet.

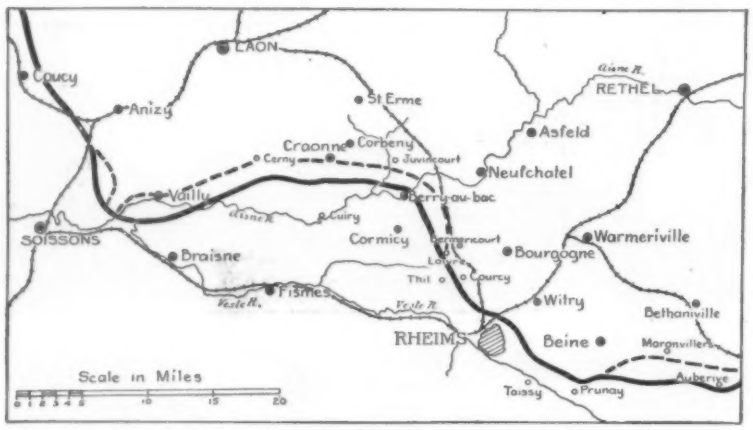
There are many signs too that the German soldiers are becoming demoralized and that their officers are in many cases losing control. The quality of the prisoners taken show that the older troops are disappearing and that men of all classes and conditions are being pushed into the ranks to take their places. The replacement of trench warfare by open field fighting is also another factor that is telling against the German forces; as they were the first to change from open field to trench fighting, so they dislike the more leaving the comfort and protection of their dug-outs and tunnels. Even now, when the constantly increasing volume of British gun-fire will allow, they dig in at every opportunity. This confirms the British opinion that such protection softened the men and rendered it all the harder to control and direct them when it came to open field or open trench warfare.

In the British service this open field training has been carried on when possible ever since the organization of the present armies began in 1914; since the present advance started, the results of this training have been most apparent and will prove more valuable as the field operations, now undoubtedly coming, widen more and more. The whole struggle promises to be the greatest of the war. The British and French are prepared as never before, and are coöperating with a unity that works smoothly and that comes from a complete understanding of results desired.

The Germans have more troops on this western front than was deemed possible a year ago; already ten divisions of Germany's best troops have been practically destroyed by the British drives and in their own counter-attacks. The number of men that will be involved in the general battle that will come along the entire front of five hundred miles can only be roughly guessed. Counting 5,000 men per mile, this would give two and a half million on each side on the 500-mile front. The Germans are estimated as having one and a half million in reserve and the English and French equally as many. Along the present French line of attack from Soissons to and east of Rheims, the French are opposed by 19 divisions of reserve—about 285,000 men—and of French troops engaged are believed to number twice that strength themselves.

The fighting on the English front for the past five days has been more particularly around Lens and its fall would be a most signal victory for the English. The city is the center of great manufacturing industries, but is chiefly notable for its coal mines and as a mining center. The shortage of coal in France during the past winter has been severely felt and England has been called upon to make up the deficiency. While it is evident that many of the pits will be damaged in every way possible by the Germans before retirement, many of them will no doubt be in a condition that can be readily repaired and work begun. Unlike the retirement farther south which was in many places voluntary by the Teutonic forces, if Lens falls, it will be a case where they were forced out against their will. And here will be the beginning of the destruction of the well-arranged German plot to seize and hold the coal and iron regions of France and thus reduce her to the grade of a second rate nation.

While the English have been steadily advancing their lines in their drive on Lens, to the east and southeast of Arras, and towards LeCatelet and the main line of German communications between Cambrai and St. Quentin, the French commander launched a great offensive movement on the 16th in a front of 25 miles between Soissons and Rheims. The battle ground is the line of the Aisne to which river the Germans fell back after the battle of the Marne; from their positions there, the Allies have never been able to drive them. For ten days the French had kept up a continuous cannonade which was a warning to the Germans of an intended attack; the latter had evidently massed many men and guns on the front to resist the thrust. North of Berry-au-Bac on the Aisne, and at a point about midway between Soissons and Rheims, a wedge was driven by the French despite a most desperate resistance on the part of the Germans; a large number of prisoners and a great quantity of supplies captured showed the results of the attack.



French advance east and west of Rheims—April 19th, 1917

The most difficult fighting was on the front of about eighteen miles from Soissons to Craonne where the plateaus of Craonne that have been so often fought over in previous wars furnished strong defensive positions of wooded districts and quarries capable of strong defense. Even here the French drove forward, capturing front line positions on the entire front. In addition to the great offensive mentioned, the French struck another blow on the 11-mile stretch east of Rheims from Prunay to Auberive. Over this distance the German front line positions have been carried together with many support positions. The German lines have been pierced to a depth of two miles, a salient around the village of Auberive has been wiped out, and that place has been captured. All these movements have added Laon to the list of important supply stations on the German line that are threatened by the British and French attacks; it is apparently the direct objective of this part of the French commander's attack; its capture would undoubtedly lead to the abandonment of lines back to Mézières and the Meuse. As a whole at present the great battle is extending over a front of nearly 150 miles and is being pushed with all the energy that months of preparation and unlimited quantities of supplies and men will warrant.

Summarizing, the objects of the present great offensive can be stated as follows: The British struck at the northern pivot of the German retirement in the fighting around Lens and the capture of the Vimy Ridge. The French are doing the same thing against the southern pivot of the retirement by the strong assaults upon the Craonne plateaus which, taken all in all, are a stronger position than the Vimy Ridge. So far as the French attack has developed, it has pierced the German lines only about two miles while the British smashed through the German positions in an advance of six miles. If the Allies now penetrate the hostile lines and gain a success at both the north and south ends of the lines of retirement, the entire German center in France from Lens to Soissons will be in danger of being surrounded and must make a rapid and costly retreat. It is too soon to draw general conclusions as to the ultimate results of the success or failure of the great offensive, but the following can be stated. The direct objective of the British is Douai ten miles back within the German lines; Laon at the other end fulfills the same purpose for the French. The capture of either city would probably be the end of the German position in France; the fall of both cities would mean a great disaster.

Little or nothing in the way of military operations of great interest has taken place on the other fronts in Europe, bad weather having prevailed generally over the continent. Reports just received state that the Germans have burned the towns of Braila and Focsani in Rumania. If true, this foreshadows an early retirement in that region.

Interest has again centered in Mesopotamia where the British forces advancing north on the Tigris and northeast on the Diala River drove back the Thirteenth Turkish Army Corps which had advanced into the space between the rivers to check the British advance. The Turks retreated toward Dely Abbas and the Jebel Hamrin hills which lie between the Tigris and Diala rivers and which Rhave been their base for operations against both the British and Russians in that section. The latest reports are that the British have continued their pursuit of the Turks up the Tigris and they are now ten miles from Samara, 70 miles northwest of Bagdad, and about one and a half miles from the railway station of Istabilit where the Turks are apparently preparing to make their next stand.

In Palestine the British are investing Gaza two miles from the Mediterranean and 48 miles from Jerusalem. It is reported that their armored cars, cavalry and camel corps have even approached to within 25 miles of the Holy City. These mobile squadrons have already rendered untenable the Turkish positions on the railway to Beersheba. This railway—which is a part of the Damacus-Medina system that was isolated in the south last summer by the Arabs of the Grand Shereef of Mecca—is the only line of communication of the Turkish Army in Syria that connects with the Bagdad railroad at Aleppo. The British are now only twelve or thirteen miles west of this line, where it makes a detour between Beersheba and Jerusalem to escape the hills on the west of the Dead Sea. It is not therefore believed that the Turks will try to keep their base at Beersheba but will concentrate in front of Jerusalem and the Jerusalem-Joppa railroad for the defense of this highly prized and much fought over land.

It is not always recognized that Palestine has great strategical value when the defense of the Suez Canal and Egypt are considered. From prehistoric times the plateaus of Syria have always been the gates for all invasions of Egypt. Over this route came Hyksos and Persians, Greeks and Romans; and in the thousand years after the fall of Roman power army after army of Arabs, Turks, Crusaders and Mamelukes came into Egypt through the Syrian gate. For fifty centuries or more those who have ruled in Lower Egypt have never felt safe when an enemy occupied Syria. So that at present, if Turkey were not defeated in this war and if Germany continued her predominating influence in that country, Egypt and the Canal would always be exposed to a hostile attack from the direction of Syria. Once occupied by the British it can be easily defended for it has the Mediterranean on the west and the desert on the east. The latter cannot be crossed by troops and England's command of the sea would always prove a barrier to any hostile force invading the country from the west. What Great Britain will do with Palestine when once conquered and firmly established in her possession has not yet been decided. With her well-known liberality of religious thought and feeling and with American support as an ally, no doubt a Palestine of the Jews will result as of old. Not all the Jews of the world would return and establish themselves there, it is true; but a 'nation of Jews,' supported by strong English, French and American influences, would again bring Jewish thought and Jewish culture to the land of its birth.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

Inventions and the War

To the Editor of the SCIENTIFIC AMERICAN:

Inventions are concededly the greatest factor in the European War—the World War since the United States, Cuba and South America are falling in.

Now, if inventions and inventors are such a power in war why is it that our governments do not follow common sense business policies and adopt a system which will promptly recompense and award inventors for useful inventions so that such inventors may proceed with their useful work to the fullest extent of their ability?

Much is being said about preparation for the great commercial war which will follow the present war of blood, and if the United States is to be first in industry the products of our industries must represent the most advanced art.

The European countries have made enormous progress in manufacturing and in the training of their women as well as their men in industrial and economical life, and therefore the whole world will advance much more rapidly after the war than heretofore. The United States as a country is in the race with certain handicaps, and it behooves us to improve our opportunities, and one of the greatest opportunities is in invention because inventions are the foundation of industry.

Invention and inventors are handicapped because Government officials and business men generally, not being inventors, do not fully understand the subject. The present is the psychological moment for urging long needed improvements in our patent system and the awakening of our people to a full appreciation of the part invention plays in war and our industries.

It is with this in view that I have proposed a system of awards, a Government Board of Invention and Research, and a Board of Award and Equity, and certain improvements in our patent system.

Lord Northcliffe says in the New York *Tribune*, April 16th: "There is no time for starting a lot of new experiments with wing and engine design."

The writer has great respect for Lord Northcliffe's opinions. If he means that there is no time for governments to do these things he is right; otherwise, wrong.

Lord Northcliffe is not an inventor. He does not know and no man knows what the inventors of the world can do if given a chance. Neither does any board of Government experts know and, by presuming to advise and dictate in things they do not know about, they may cost their country hundreds of thousands of lives and victory in war.

Ever since the European War started England has foreseen the possible finish of the war, next year—the finish always a year ahead. The war may terminate within this year but for many good reasons it may continue three or five years more.

Suppose the Germans are now building a new type of air-craft engine which is 100 per cent better than our present inefficient motors. A new engine of this kind will enable them to put in service very superior air-craft, faster machines, longer life and better service machines, and, above all, the much needed big battle-planes and sea-planes.

Improved sea-planes might easily double Germany's submarine efficiency. Improved battle-planes of large size mounting 3-inch guns and powerful bomb and aerial torpedo apparatus, could carry on most effective raids against cities and munition plants, compelling England, France and even the United States to devote a considerable share of their output in guns and munitions, as well as expert fighters, to protecting every city, town and factory in their whole territory.

Lord Northcliffe, and the people of the United States as well, should bear in mind this important fact, viz., that aerial warfare opens up not only the sea but both the sea and land to the same surprise warfare as is now carried on so successfully by German submarines.

Hostile battle-planes and fleets of air-planes can hide in the clouds and in the dark and, for that matter, in the day sky just as German submarines now hide under water and, like the submarine, they can attack without a moment's notice and, until such attacks are made, we will not know whether it is a friend or foe above us.

Lord Northcliffe says in New York *Times*, March 4th: "There is a fruitful field for the inventor who can develop types of aeroplanes that can land on ships, start from rough water, and be practical for sea observation."

A practical question I would like to ask is—How fruitful to the inventor may this field be? Does the British, or the United States Government, offer a million dollars to the inventor for such invention?

Inventors are probably as patriotic as the average person, but it takes a lot of money to develop inventions, and men with money are not financing inventors unless they can see prospective returns. Inventors who have been financed on the patriotic basis by patriotic citizens are scarce.

If Great Britain and the United States should each offer a million-dollar award for the government rights for such an aeroplane invention this would be a stimulus to inventors and enable some of them to find the money for carrying out their projects.

The quickest and cheapest way for the United States and the British Governments to get a new type of motor, 100 per cent better than motors now in use is to offer a million-dollar award for the government rights. It would cost nothing to offer it and it would be worth millions to get it.

A million award may save a million lives and decide the war.

W. H. FAUBER.

Brooklyn, N. Y.

American War-Ship Design

To the Editor of the SCIENTIFIC AMERICAN:

It is a well-known fact that for the last ten years American battleships have displayed an excellence of design, unexcelled by the ships of any foreign navy. As compared with foreign ships of equal date, they are superior in all-round fighting ability. Although our pre-dreadnought battleships are on a par, if not superior to those of England and indeed far superior to those of the German navy, the real excellence of American battleship design began with the "Michigan" and "South Carolina." The wisdom of placing all the big guns on the center line has been proven by its adoption by both Britain and Germany. It is a feature of the German battlecruiser "Derflinger" and the dreadnoughts of the "König" class. Foreign naval officers and critics have always acknowledged the excellence of American dreadnoughts.

In 1911 at the great naval review at Spithead in celebration of the coronation of George V, the United States was represented by the "Delaware." The German Government sent its latest ship, the "Von Der Tann," and the most powerful British ship at the review was the "Neptune," fresh from the yards. After visiting the various ships, British officers declared that the "Delaware" was the best ship in the assembly. American naval officers had no doubts as to this. Sir Maurice Prendergast, the great English authority, says: "During the past ten years, the design of American battleships has displayed a remarkable standard of excellence. For neatness of design the American ships are *facile princeps*—a striking contrast to some dreadnoughts whose minor details seem to have been "shoveled in just where they would fit as a sort of afterthought. The new American ships will probably be the largest afloat for many years after their construction." Before a meeting of Italian naval architects in 1913, a prominent Italian naval officer, in urging better all-around armor protection, stated that the ships of the United States were the best protected of any navy, both above and below the water-line. This is undoubtedly a fact. The system of underwater defense in our latest dreadnoughts is far in advance of anything ever before attempted.

The Navy Department is about to embark on the construction of four giant battle-cruisers. The designs of these huge ships are superb in every detail, provided, as the SCIENTIFIC AMERICAN has urged, the plans for the electric drive, necessitating, as they do, the placing of a large portion of the boiler plant above the water-line, be altered in favor of some scheme which will put the entire boiler plant beneath the protective deck. Indeed, it would be almost better not to build these much needed ships at all than to commit such a grave technical error and expose them to sure destruction. Certainly, those responsibile for our ships of war are not going to permit such a needless error to spoil a splendid record.

W. D. REICHMANN.

Chicago, Ill.

A Complaint from a Right-Thinking American

To the Editor of the SCIENTIFIC AMERICAN:

For over ten years I have been reading both your papers, and have looked forward with pleasure to each post-day with its new issue, on account of the extreme authoritativeness of your invariably timely articles. Especially welcome was your impartiality in all matters, scientific and political alike—until the outbreak of the European War.

But in this respect your sheet has unfortunately deteriorated greatly during the past three years; and this surely has robbed it of the best part of the esteem in which it was held, not only by me, but likewise by *other right-thinking Americans*. During these three years you have let slip hardly an opportunity to speak maliciously in your editorials of the Central Powers. In this you prove your own incapacity in the eyes of people who know Central Europe at first hand. Apparently the writer of your editorials has himself never set foot outside the boundaries of your country, or else he reckons on the lack of vision and the superficiality which seem to constitute the mental equipment of the larger part of your reading public.

This exhibits itself most noticeably in your editorials. As to the discussions of your "Military Expert" one may really best maintain silence. Although in the course of the last three years you have made numerous changes in the identity of this "Expert," the quality of his productions has remained substantially the same. In the event of war, it will unquestionably be to the highest degree significant of the fate of the United States if her commissioned officers understand no more of their profession than do the various so-called "Military Experts" upon whom the readers of your sheet have had to rely during this time. Their articles have consisted entirely of prophecies which in no single case have been fulfilled, and in connection with which anyone can see that the wish of an Allied mind was father to the thought.

To your credit, I will admit that your paper has not profited directly from the so-called "Secret Service Fund" established in France. But unfortunately you appear to believe that your articles must be tinged with sympathy for the Allies, since the greater part of your readers presumably consist of persons born in these countries or sympathizing with them. Or is it to be inferred that Wall Street and the munitions makers exercise, through your patent department, an influence upon the color of your pages?

If any one of your readers feels impelled to side with one or the other of the European belligerents, he will by all means do best to follow the appropriate daily paper. Therefore I believe that for your particular sheet it would be best, if you would divorce yourself altogether in your articles from consideration of the war, and confine yourself to strictly neutral bulletins upon technical and scientific subjects.

M. C. J. MOHR.

[The above communication comes from Mexico, and is written in faultless German. The translation, in which the italics are the Editor's, seems to require no special comment. As a sample of Teutonic thought and argument it should take a leading rank.—THE EDITOR.]

Patents in Escrow

To the Editor of the SCIENTIFIC AMERICAN:

Taking up again my proposal of "Patents in Escrow"—that is to say, the placing of patents at the point of issue in the Commissioner's hands, safe from interference and saving the abandonment of foreign rights which now occurs on issue and publication—it is obvious that such a privilege would be a very valuable one in the event of war, as then American inventors could refrain from having their patents issued until after hostilities had ceased. To issue patents in war time means to give our inventions to the enemy country. Surely this would be a grotesque use of our Patent Office.

I have heard no sound objection urged against the idea of "Patents in Escrow." The objections which were made in the footnote to my letters as published in the SCIENTIFIC AMERICAN are beside the case. You stated that it is possible to file patent applications in most foreign countries during the year following the filing of the application in the United States. Even so, that does not meet my objection that the American inventor must disclose his invention to numerous persons in the effort to get capital for foreign applications, which may breed interferences in the American Patent Office and even lead to loss of his invention at home. And it does not apply to the large number of patents which do not reach issue until more than a year after the filing of the application.

The fact that a patent can be delayed six months after allowance before issuance, which is in a measure a holding in escrow, is also no reason for not permitting patents to be put in escrow, for during that period, the application is not free from interference, and is still unprotected. What I recommend is an application in such a state that it is free from interference, so that it may be safely disclosed as far as American rights are concerned, when the effort is made to get capital for foreign applications. This would greatly stimulate the taking out of foreign patents with consequent benefit to American inventors, who certainly should be entitled to benefits for their work, rather than have the benefits go to citizens of foreign countries, and perhaps enemies.

As for the public infringing a patent without having an opportunity to examine it; such a condition is very unlikely to arise, since most infringements spring from publication in the *Official Gazette*. In the case of such an infringement, however, the inventor should not be entitled to recovery until infringements had occurred after notification by him.

Inventors feel that there should be no disclosure of an invention until the expiration of a patent, except to actual infringers. As court proceedings are so costly, it seems unjust to advertise to the world a new invention with complete directions for carrying it out. In justice this should not be done unless the Government stands ready to guarantee the rights it grants. Some day that point will be reached.

EDWIN HOPKINS.

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A Bleriot monoplane used by the British expeditionary forces in France during the early days of the great war

An early Farman biplane equipped with a Gnome engine. This machine is crude indeed compared to the modern battleplane

Britain's Bid for the Control of the Air

Training the British Airmen for Army and Naval Service

By Lieut. G. L. Faulkner of the British Royal Flying Corps

AT the beginning of the war there were about two hundred qualified aviators in Great Britain. The majority of these airmen were connected with the army branch, but there was also a number of individuals engaged in exhibition flying and therefore available as instructors and for actual service.

Up to the time of the outbreak of the great war, the principal work undertaken by both civilian and army flyers was that involving altitude and distance tests, together with certain spectacular features. Bomb dropping was attempted with indifferent results as far as skillfulness was concerned. In a word, flying before the war was regarded in the light of a sport by the British, and newspapers played an important part in arousing popular interest. Large prizes were constantly awarded for distance and altitude flights, and the achievements were more in the line of general appeal than practical development; indeed, large crowds attended the meets and exhibition flights. In the direction of aircraft wireless and aerial gunnery it must be admitted that nothing was done, because the demand for these things had not as yet become evident.

Great Britain's relative position was third in the development of aerial navigation as applied to warfare. Germany led and France came next; but Germany's preparation had been undertaken in the same measure and with the same thoroughness which characterized the organization of her other departments.

The Dark Days of Britain's Air Fleet

The Central Flying School at Upavon, Salisbury Plains, was the only well-equipped place of instruction for pilots. Here both the military and naval branches of the service secured their flyers. The school, in turn, drew its material from various civilian sources, particularly from the universities and schools where some slight instruction was given in aviation, preliminary to the course at the Central Flying School.

When war was declared all available pilots and equipment were at once sent to the front. For a long time afterward, there was a scarcity of instructors and of advanced students capable of acting as instructors. England, be it remembered, saw discouraging times during 1914 and 1915, because of the difficulty of replacing the pilots lost in action.

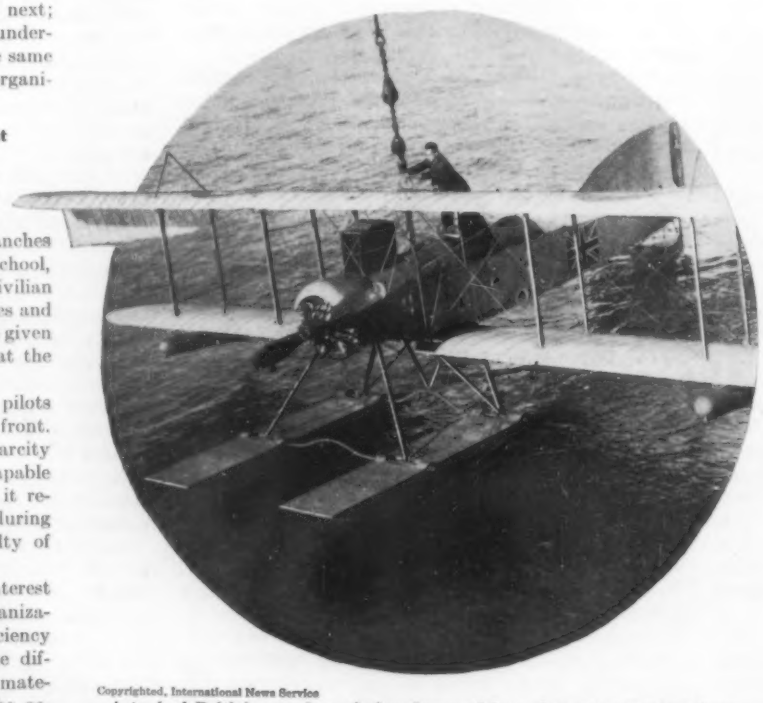
It was only by enlisting the patriotic interest of manufacturers of engines that an organization of anywhere near the necessary efficiency could be produced; for aside from the difficulties of producing a personnel, the materiél forces were sadly incomplete for the occasion. France was appealed to for the supply of ideas for engines and also for the construction of these vital necessities. A short time later the British government arranged for a meeting of the engineers of both countries, in order to bring about an interchange of ideas not only based on their experience, but also on the study of German machines brought down within the Entente lines in the course of battle.

The British government extended a helping hand to inventors not only in Great Britain, but in all the Allied and neutral countries, who were invited to submit their ideas. No cost was considered too great in rounding out the flying organization and wresting from Germany the supremacy of the air.

AIRMEN are not born: they must be trained. Flying—plain flying—alone requires several months' training, while artillery spotting, wireless telegraphy, aerial photography, observation, bomb dropping, machine-gun handling, and other kindred phases of the military flying service require as many more months. In the present article the author, a Canadian airman now in this country, tells us how Great Britain has solved the problem of a huge flying personnel. The facts given are those of the author, who has had ample opportunity to study the training of British flyers at first hand. In subsequent issues it is planned to tell something of Great Britain's solution of the materiél problem, which, after the personnel, is the biggest factor in building an air fleet. Fighting tactics will also be discussed in a future issue.

—EDITOR.

The officers of the different regiments of the army, particularly the artillery and machine-gun sections, were called upon because of their familiarity with shells and different types of guns, which fitted them for artillery observation work. The machine-gun officers possessed a knowledge of these weapons which made them invaluable as machine-gun instructors. Thousands of these officers were transferred from their regiments to the flying corps, together with civilians who were attending Oxford, Cambridge and other universities throughout the country. Also, great numbers of Canadians and Australians who had secured a pilot's license in their own countries, joined this branch, and received their commissions as temporary second lieutenants until they received their wings, which confirmed them in their rank.



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A typical British seaplane being lowered into the water "somewhere in the Orient"

The Evolution of a British Flyer from Landsman to Airman

The officers just mentioned are sent to colleges throughout the country, that have been transformed into engine instruction schools. There they receive a thorough training in all classes of rotary and stationary engines, among them the Gnome, Clerget, Gnome-Monosoupape, Rolls-Royce, Beardmore, Austro-Daimler, Green, Woolsey, Sunbeam, Renault, Armstrong-Whitworth, Royal Aircraft Factory, Curtiss, Sturdevant, Hispano-Suiza, and a number of other engines built in Italy and America. It will be noted that the Curtiss and Sturdevant are American engines, while the Hispano-Suiza, although heretofore built in Spain, is now being built in America.

From this school of engines the pupil is sent to an aerial gunnery school and there trained in shooting with a Lewis machine gun placed in a Vickers fighting gun-bus. This aeroplane is capable of traveling at the rate of from 110 to 120 miles per hour, and from it the pupil must shoot at small balloons of about the size of a football, which are attached to the tail of another machine. Training of this kind soon results in making a good aerial gunner of the pupil, although obviously much practice must be indulged in before he can become a first-class shot.

Passing on to the aero bombing school, the pupil is trained in the art of dropping bombs until he becomes quite accurate in aiming at moving and stationary objects on the ground. A bomb-dropping device is used in these operations, which facilitates the work of the pilot to a great extent.

Next comes the school of aircraft wireless. Here he is given instruction in signalling to batteries in target practice. The pupil learns to direct the fire of different types of guns from the air at a distance of 8 to 10 miles, and at a height of 6,000 feet. This, as is well known to everyone who has followed the descriptions of the latest battles on the Western front, is a most important branch of the service; for the direction of modern artillery fire is usually under the entire control of the man high in the air.

The pilot is next taken to a stunt school, where he must fly in all kinds of weather—during rainy days, snowstorms, windy days, and so on. He must also master the various tricks such as the loop and sideslip, outside slip, and the spinning nose dive, and be able to take himself out of these stunts before getting into the danger zone. In ante bellum days these stunts were hardly known, and master-airmen, such as

Pegoud, who were the pioneers in them, were acclaimed by the public as super-flyers. Yet today the British airmen training for service at the front must learn all these stunts; indeed, the latter have become quite commonplace in modern aerial duels. With this sort of finishing-off, as it were, the airman is ready to begin his training in actual flying by himself.

The "huns," as the men are called who have not yet become pilots or received their wings, are sent to different training schools throughout the country and there taught to fly on the easiest machine in the world. This machine, the Maurice Farman of the short and long horn types, has turned out more pilots than any other type in existence. Great Britain, France, Russia and Germany have trained 98 per cent of their pilots on this type of biplane. At the present time there are over 100 Maurice Farman schools in Great Britain, notwithstanding the large number of schools that are scattered throughout different parts of the Empire. But to return to our immediate subject: without anyone else in the machine, the pupil must be able to fly by himself within five hours' instruction; if he cannot finish in this time, he is returned to his own regiment. To the layman this requirement may seem unusually severe, but not so when it is explained that the average time for pupils to master flying by themselves is two and a half hours actual flying time.

To a more advanced school the pupil is now sent, where there are more difficult machines to fly, notably the A. V. Roe biplane fitted with a rotary engine of the Gnome or Le Rhone make. This machine is very delicate as regards its response to the controls. Next comes the Henry Farman, also equipped with a rotary engine and also provided with delicate controls. It is particularly intended to teach the pilot how to land. From the Henry Farman machine the pilot is transferred to the Bleriot monoplane, which is flown principally by the rudder control and is quite difficult to land.

Now the pupil is ready for the Morane Parasol monoplane, a French machine carrying the Le Rhone rotary engine. This machine is difficult to handle because of the delicacy of the fore-and-after controls. Instead of being helped to gain its height by pulling gradually on the elevator control, as is done with all the other types, this machine must be allowed to lift itself on a very much smaller angle. It is handled principally by a rudder control, and is a very nasty type in bad, windy weather; but in calm weather it is one of the finest aeroplanes. During the landing operation it must be brought down at 80 miles per hour and directly into the wind. The French government has done away with this type of machine for war purposes, although early in the war it was employed for artillery observation.

When the pilot can successfully handle the Morane Parasol without assistance, he is ready to pass to the Morane Bullet—a small, one-man scout monoplane which travels at the rate of 110 miles an hour. This machine is fairly easy to fly; it is very quick on the controls, and, when turning, its nose must be lifted because of the speed. Many pilots boast of their high degree of skill in being able to fly these diminutive monoplane- or biplane-scouts, and they even try to put the fear of God into the pilots who fly the slower and larger types of machines, by telling them that they will "break their necks" at the first attempt to get off the ground or to make a landing. This is exaggerated and boastful talk, and is most damaging when made in the presence of new pilots who are desirous of getting on to these scouts.

The next step in the evolution of the British airman, who by now is pretty well out of the cub class, is to try his hand on the Nieuport biplane bullet, a very fast French tractor-type machine which is doing commendable work at the front. This machine loops very easily and can be flown for a short period with all hands off. It has a speed of from 115 to 120 miles an hour. Following this machine is the Spad, which is also a tractor-type of French design, capable of making a speed of from 140 to 145 miles an hour; and finally come the De Haviland back-staggered machine, the Sopwith Pup, the Sopwith Fighter Triplane, and the latest machine of the Sopwith shops, which is accredited with a speed of 152 miles an hour. Latest reports have it that the last-named machine even now is surpassed by another machine capable of a speed of 2,000 feet per minute up to 15,000 feet.

With the thorough training just outlined, the pupil is ready for the front in the capacity of scout pilot. That he is prepared in every way is obvious from what we have just read concerning his school work.

How to Become an Aerial Marksman and Bomber

In the training of a battleplane pilot the pupil is taken from the Maurice Farman short-horn machine, after he has successfully flown by himself in less than five hours of instruction, and put on a battleplane which is not mechanically, but inherently, stabilized. This machine flies on a level with all hands off. It makes from 115 to 120 miles an hour and is equipped with a Rolls-Royce engine developing 350 horse-power. It weighs about two and one-half tons. This huge battle-plane carries three machine guns which are mounted on a revolving rack in such a manner that the observer, sitting on a stool, can whirl around and handle any desired gun.

After flying the battleplane for ten hours by himself and having acquired a thorough knowledge of bombing, night flying, aerial gunnery, artillery observation, map reading, reconnaissance and

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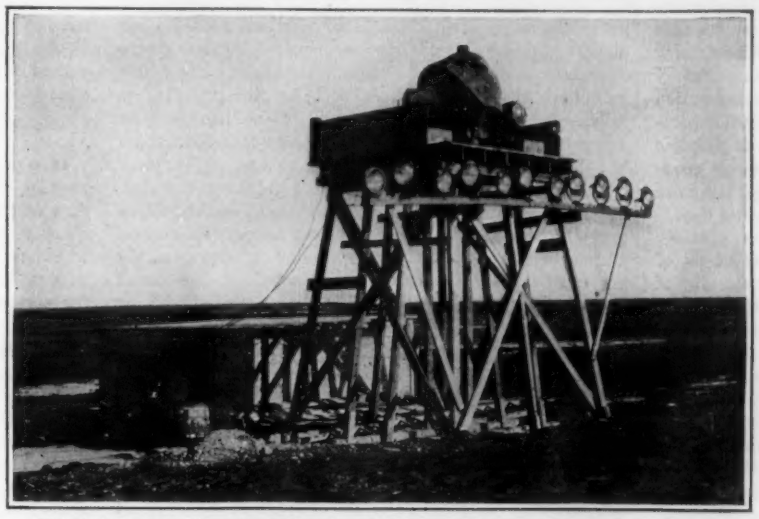

This lighting stand at the Mineola flying ground serves the dual purpose of guiding nocturnal fliers to a safe landing, and detecting hostile aeroplanes

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American-built land battleship or "tank" recently tried out by the Citizen army at San Francisco, Cal.

A great British howitzer with a range of 12,000 yards, nearly 7 miles This gun is the handiwork of women machinists

A Lighthouse for American Airmen

IN anticipation of a series of experiments in night flying which is soon to be undertaken at the United States Army flying school at Mineola, Long Island, there has been erected a novel lighting stand for a dual purpose: first, to guide friendly aviators to a safe landing place; second, to detect hostile aviators flying in the vicinity of the field, making them the victims of anti-aircraft artillery and the defending aeroplanes, which are hidden by the inky blackness of the night.

The lighting stand, as will be noted in the accompanying illustration as well as in our cover design, is a rough wooden structure upon whose platform are mounted three searchlights, and carrying a wooden beam which mounts eleven flood-lighting projectors. The searchlights, one a high-power Sperry searchlight and the other two portable trench searchlights, serve to pick up hostile aeroplanes. The flood-lighting projectors, in turn, serve to illuminate a strip of ground some thousand feet in length and thirty or more feet in width, in which a nocturnal flier can readily land in safety. Electric current for the searchlights and projectors is obtained from a gasoline engine and generator power plant located in a wooden shack at the base of the lighting stand.

The Citizen Army at San Francisco Tries Out a "Tank"

EVER since the British army introduced the "tank" or mobile fort or land battleship or whatever else one chooses to call it, the "tank" season has been in full swing; for in every country belligerent and otherwise the inventors are at work designing mobile forts which, while differing in outward appearance and in minor details, are all based after the famous British "tanks."

A few weeks ago we illustrated an American "tank" recently tried out in California with promising results. This time we illustrate another American "tank" which has been patterned after the British land battleships. Although constructional details are lacking, it may be said that this machine, like all other "tanks," has a track-laying and cogwheel system of propulsion. Its unique features are the turret provided with a number of loopholes, and the peculiar, rounded-off body. During the recent manouvers of the citizen army of San Francisco, Cal., this latest "tank" proved most effective in tearing down wire entanglements and smashing wooden houses.

Big British Howitzers As the Product of Woman's Handiwork

IT is a far cry from housework, sewing and the care of children to the turning out of huge howitzers which are to deal destruction and death among the enemy in the far-off battle-line in France, yet with wonderful versatility the women of Great Britain have turned their best efforts to the manufacture of the largest British guns, not to mention their activities in every other field of armament and munition production. If Great Britain has been able to raise one of the finest armies the world has ever seen, it is due to the women at home who have taken over the tasks of the men in the shell- and gun-producing shops.

The huge increase in the British production of weapons and munitions since the war began has been little short of a miracle. There are now being manufactured in

(Concluded on page 429)

Our Mobilization of Food

How We Are Going To Feed Ourselves and Our Allies

THE United States starts nearly three years ahead of England, France and Russia in knowledge. We begin now, when our part in the great war is just starting, to face the problems of which they had first to realize the existence, then to discover the solution; and we face them with this great body of hard-acquired knowledge to back our plans and make them fruitful. Luckily for us, not only are we the greatest food producing nation in the world, but one of our greatest Government departments is highly organized and well equipped to mobilize these food resources, to make them care for our needs and for the foreign demands which we must fill if we are to aid the Allies as they must be aided in order to win.

Nor have we lost any time. Sixty-two officials, representing agricultural colleges and commissions of thirty-two states, met at the request of the Secretary of Agriculture to confer with representatives of the Department in St. Louis, April 10th and 11th. After dealing with the general problems of financing agriculture and organizing effective Federal and State coöperation, the conference made a special appeal to the patriotism of farmers and outlined a definite program looking to the increase of cereals, legumes and animal products. With a Congress which has so patriotically supported the President, and with a nation united behind the President and its representatives in Congress, there is small doubt that all the program outlined in this conference will be immediately made possible by the necessary legislation.

We must have a large appropriation—not less than $25,000,000—to enable the Secretary of Agriculture to meet the extraordinary demands. Increased production means increased financing, and as the need is governmental the financing must be so too. Next we must have labor—and if two million lads between fifteen and nineteen years, with another million of men unfit for military service, can be made into an officially recognized force to cope with the neccessity for increased production, the labor problem will be solved.

New Executive Machinery Necessary

The Department is now proceeding to make an adequate food supply survey of the whole nation—learning exactly what is on hand, what is to be expected, what new areas are being planted and in what crops, what food is in storage, what the prospects are in every crop, so that the authorities can proceed on exact knowledge and not on hopes. Able, willing, thoroughly equipped to handle the situation in coöperation with the Council of National Defense and the Army and Navy heads, the Department of Agriculture is yet convinced that some additional machinery is necessary. So far, no suggestion that a Food Dictator be appointed has officially been made, but a campaign is already under way for systematic publicity of food prices and effective control of commission houses, storage warehouses and all agencies for the manufacture, handling and sale of food. The Department desires to put into operation at once a system which will correlate the activities of already existing agricultural bodies.

To this end it plans, if possible, to establish a relatively small central agricultural body in Washington composed of men with wide knowledge of agricultural matters and executive experience. In selecting these men, particular attention will be paid to geographical distribution. To work in connection with this body a large national advisory commission will be formed, composed of representatives of leading agricultural agencies and associations concerned in both production and distribution.

Finally, small central agricultural bodies will be created in each state, representing agricultural officials, agricultural colleges, banking, business, farmers' and women's organizations which may be concerned in the production, distribution and utilization of food supplies and agricultural raw materials. It is planned to have these designated by the Governors and coördinated with any central councils of safety which the states may already possess.

With this additional machinery, the Department of Agriculture can work out its plans quickly—and time is very important, because within the next sixty days the crops of the year will have been determined. At least, the maximum possible will be decided; no one can tell how far the final yield may be cut by bad weather and labor conditions.

Where Increased Production Is Coming From

The new machinery is not asked to handle a situation of vague possibilities, but to get to work at once on some very definite plans. Surveys are already completed to the extent that the Department knows exactly what must be done to make our crops adequate for the unprecedented demands which will be made upon them. In brief, the newly created machinery for food mobilization will be asked to increase the spring wheat acreage in Northern states and the corn areas east of the 100th meridian, to replant with oats, corn, or sorghum, districts where wheat has been winterkilled, to plant the maximum crop which can be handled of barley and oats, to increase the buckwheat acreage in such northern and eastern states as have a season too short for great staple crops, to enlarge the areas planted in navy beans in the north and west and those in the Southwest where Mexican and Tepary beans are grown, to stimulate potato planting for local use, to work for an increased production of sweet potatoes in the South, both for use fresh and for storing, canning or desiccating for winter use, to enlarge the production of peanuts, etc.

Meat and Animal Products

The necessary seed will be made available, under proper safeguards, by the Department. But it will also attempt to see to it that, in their enthusiasm for more and bigger crops, farmers do not denude their farms of pasturage; for live stock production is just as important as vegetable crops, and without pasture stock cannot thrive. In stimulating animal production, the Department is fully conscious that pigs and cattle are not a matter of a few months' growth. So that the first effort to be made will be along lines rather of conservation than of increased production of beef, mutton, pork, etc. Contagious diseases destroy food animals to the value of more than $250,000,000 annually; and at least half of this amount is traced to controllable disorders.

Realizing that it is impossible to stimulate a great increase in available meat in the same short time that is sufficient for increase in other food products, the Department has definitely planned for price control of meats. Julius Rosenwald, of the Council of National Defense, arranged a conference between the Secretary of Agriculture and the leading packers of the country, at which an agreement was reached assuring the preservation, for the period of the war, of a standardized price for meat products, based upon the cost of production and transportation. The general demand for price reductions in meats and other staples controlled by the packers had already convinced the heads of the industry that radical measures were needed, so they were prepared to meet the Government more than half way. The Council of National Defense believes the packers can find a way, through the creation of a Federal agency for the distribution of their products, to prevent the setting of prohibitive prices by middlemen.

It is the opinion of experts in dairy and poultry farming, that the milk production can be increased 25 per cent by more liberal and intelligent feeding, and that poultry products can be doubled within a year if the necessity is but made plain and farmers will coöperate.

Milk, of course, is not an exportable food; but beef is, and milk consumed in quantity at home will release for shipment abroad much beef otherwise eaten here. It is never lost sight of in the Department's plans that our task is not merely to feed ourselves—a thing we have always been able to do and which not even a crop shortage would prevent our doing—but that we must feed our Allies abroad, and feed them well. It is not a case of exporting food for commercial reasons, but to render the greatest service in the war. It will take us a year at least to train, equip and transport abroad an army which would be of real value on the battle lines. If we can send enough food to release from farming duty men who are already on the ground, we save the vital thing—time.

Wanted, A "Food-Supply Corps"

It is easier to put crops in the ground than to harvest them. Time can be taken for ploughing, planting and care of the ground; but harvest must be accomplished quickly, when the crop is ripe. Hence the Department wants a "Food-Supply Corps," enlistments in which will, on their face, be as patriotic and as valuable as those for service at the front. Complete plans for such a corps have not been worked out, but they will undoubtedly include a pledge of active service in agriculture, using the word in its broadest sense, and some variety of badge or distinguishing mark by which those who so enlist may be known as rendering service to the nation.

In order to make available for market all the crops which can be harvested, a concerted effort is now being made by publicity methods to induce every one with spare ground to put it under cultivation. This campaign is being vigorously pushed in large communities, which absorb so much food, and many newspapers and magazines are lending their columns to advertising the "Back Lot Garden" campaign. Vacant ground is being sought from owners for use in raising crops, children are being urged to plant gardens in back yards, outlying districts near cities are being put under cultivation. The more vegetables are grown at home, the less will be required from farms for city use and the greater will be the quantity available for storage, export and canning.

Legislation is being sought by the Department looking to possible food and price control by the nation. In order that producers may be protected from loss in the extraordinary efforts which they are urged to make, the Department believes that the Council of National Defense should be authorized, if any emergency such as sudden ending of the war or speculative manipulation should bring about temporary or local overproduction, to purchase, store and distribute food products and to fix prices. Such a course will also prevent consumers from being forced to pay oppressive prices in case of disorganized or inadequate transportation. Information that will afford the Council intelligent data upon which to act wisely and fairly in any emergency is promised by the Department if the legislation it recommends is enacted.

Moving the Crops

Railroad coöperation is being obtained now, to the end that cars will be available for crops when and where necessary. The spectacle of grain rotting in the fields and fruit decaying on the trees because of inadequate transportation facilities, has more than once been a disgrace to certain sections of the United States. The causes of this, perhaps beyond control in normal times, in a military emergency such as now confronts the country *must* be controlled—if necessary, by Federal supervision of transportation. That the railroads, almost as one corporation, have offered their lines and their staffs to the Government and promised the fullest cooperation regardless of profit, is in itself a guarantee that those who grow crops will be able to move them.

There seems small doubt that patriotic agriculture will be backed by the strong motive of profit. It does not seem possible now that overproduction is a possibility this year. Europe is demanding of us food in greater quantities than we can hope to supply; and crop conditions, with the small winter grain yield, seem to promise a fine market for all who bend their best efforts to increasing crop acreage.

From all sources come enthusiastic responses to the agricultural appeal as made by the Government. For instance, Carl Vrooman, Assistant Secretary of Agriculture, originated, at conferences on farming preparedness in Memphis, a pledge under which the signer specified the contribution he would undertake to make toward bigger crops. These pledges are coming into the Department literally by the basketful and Southern enthusiasm is widespread. Formal meetings and speeches are followed by informal conferences among farmers to

(Concluded on page 429)

OF the many and severe lessons which the world, since 1914, has learned at a cost in blood, money and sacrifice, the total of which can never be known, none is of greater importance than the one which tells us that a war is won and lost more by supplies than by fighting. And of all supplies none is more vital than food.

This year the world's food reserve is lower than for many decades. The unthinkable consumption and the equally unthinkable waste of thirty-three months of war in Europe have steadily used up food faster than the world has produced it. Accordingly, the most intensive food mobilization is necessary—and not against some future emergency, but against the requirements of the present year.

When the United States entered the league to destroy Prussian militarism, common sense dictated that the Allies immediately place at our disposal all the facts they had gathered upon how to conduct a war. This has been and is being done; and among other things we are being told how to feed a warring nation. The experience of England and France and the present conditions in the United States have been gone into thoroughly by the appropriate departments of our Government, and a comprehensive program worked out for the enlargement of our food production for the coming summer. It is the purpose of this article to set forth the leading features of this program, especially in the aspects which most directly affect the people of the United States.—EDITOR.

Inventions New and Interesting

A Department Devoted to Pioneer Work in the Arts

Making Change by Flashlight

THE lamp which we illustrate herewith, designed to assist a bus conductor in the making of change and the punching of tickets, is a British production, and a thoroughly typical one. There seems to be no particular reason why a flashlight for this purpose should be as large as the wearer's forearm, except on the ground of the traditional British penchant for building everything on supremely solid lines. However, in spite of its extraordinary bulk, the device is plainly a most useful one.

Flashlight now used by English bus-conductors

Doing Away With Manual Labor in the Manufacture of Furniture

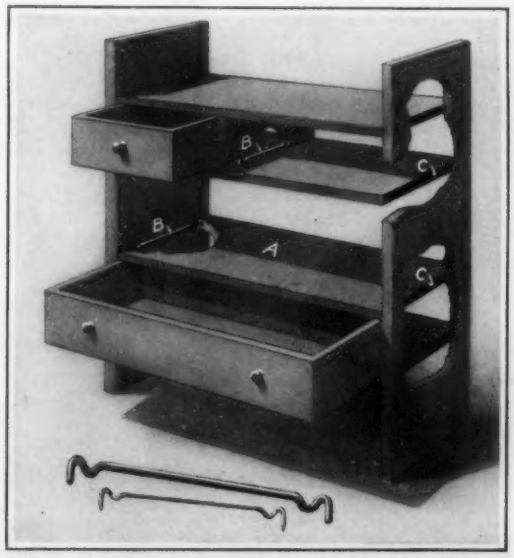
IF certain plans materialize, it will be possible for you to go to your hardware dealer sometime in the near future and purchase a predetermined number of pieces of wood of standard size, a predetermined number of another size, and a predetermined number of several other sizes, besides a number of metal fittings, and then return home and build your own bookcase, china-closet, desk, buffet, shelving, or any other piece of furniture you may desire for home, shop or office use. No glue nor nails will be necessary, since all the parts will be merely assembled together by means of the metal fittings, with the help of a hammer; and should you be occupied with other matters, your eight-year old son or daughter can assemble the standardized pieces together, so simple is the work.

The inventor of the standardized system of furniture building that threatens to revolutionize the cabinet-maker's trade is Mr. Sören Ringer, of Copenhagen, Denmark. His present method of furniture building is said to be the result of over fifteen years' experimentation and research work, during which he has produced more than 800 different models of furniture in developing the present standardized construction, every feature of which is protected by patents taken out in all countries.

The system evolved by Mr. Ringer pivots on a novel form of supporting clip made of iron and obtainable in all sizes, which serves to hold wooden members by means of a groove cut in their ends. With this construction, rabetted and glued joints are done away with, and the result is a neater, stronger, and withal, far less expensive article. The groove, shown at *C* in the accompanying wash-drawing, is cut at each end of a piece of board, *A*, and commences a short distance from the front edge, so that the supporting clips, *B*, are quite invisible. This construction permits the board to be readily pulled out and the supporting clips changed so as to alter the position of a shelf or partition, at will. It is claimed that this method of furniture building prevents warping, and that even warped wood is straightened in time. Furthermore, the supporting clips being elastic, the walls can dry without splitting. It is impossible for the supporting clips to fall out when the wooden members are in position.

There are two ways of supporting drawers in the new furniture designed by Mr. Ringer: the first, and simplest, procedure is to place a drawer of standard construction between two shelves; the second, to cut grooves on the sides of the drawer, which engage with supporting clips. In either case the drawer can be arranged to fit accurately, yet readily slide at all times; indeed, both constructions are such that there is absolutely no chance for binding, irrespective of weather conditions.

The main members of a piece of furniture—the top and bottom and the side pieces—are held together by a form of mortise-and-tenon construction. The top and bottom members are provided with mortises into which fit the tongues at the ends of the upright members. Invisible bolts, passing through horizontal and side members, are screwed into iron plates on the latter so as to secure the joint. With the foundation for a piece of furniture thus formed, the supporting clips are now employed for holding the shelving, drawers, partitions, and other wooden members. Without the aid of any other tool but a wrench, a piece of furniture built according to the ideas of Mr. Ringer can be taken apart completely and packed in a space a trifle larger than that required for the flat lumber. The value of this feature is obvious to those who are acquainted with the shipment of present-day furniture, not only to different parts of this country but to oversea buyers.



Principle used in the construction of glueless furniture, showing supporting clips and grooved members

No piece could better bring out the ramifications of Mr. Ringer's system than a cabinet which contains an entire office equipment, and which, when not in use, has the appearance of a small, narrow closet, fitted with attractive glass doors. When the doors of this cabinet are opened and turned back out of the way, as shown in one of the accompanying illustrations, there is available every facility imaginable for the carrying on of office work. There are filing cases with a capacity of several hundred or several thousand letters, according to the size of the cabinet; pigeon holes; paper racks; drawers; book shelves; and, most important of all, an adjustable desk or drawing board. The last-mentioned member is an exceptionally clever device, for it can be pulled out as far as desired and raised or lowered to accommodate the user, whether he is sitting or standing at his work. The cabinet-office can be shipped completely knocked down, and, what is more, it can be instantly varied by its user to meet the changing conditions of his work: shelves can be added or taken out; pigeon holes can be adjusted to suit immediate requirements; filing cases can be added or taken out; and shelves can be converted into drawers and *vice versa*.

Mr. Ringer believes that in time his system of furniture construction will result in the standardization and quantity production of much of the world's furniture. Conceivably, the wood can be cut at the mills to standard sizes and grooved, and sold in hardware shops together with the metal fittings, so that anyone can make their own furniture for use in commercial or private life. Particularly in the case of shelving will the system meet with its widest application, for it will be a simple matter to erect shelving in a minimum of time, alter it whenever necessary, and take it down, without skilled labor. The painting of the shelving and other furniture will be greatly simplified, since the pieces can be either dipped or painted before assembly, as compared to present time-consuming methods. Again, the painting by this method will be far better, because every portion of any piece will be reached and there will be no unsightly, unpainted spots.

Burmese Lacquer

THE Trade Supplement of the *London Times* reports a scarcity of the lacquer, obtained from the tree *Rhus vernicifera*, commonly used in China and Japan, and suggests that the shortage may be met by the importation from Burma of a very similar lacquer known as *thitsi*, product of the black varnish tree, *Melanorrhœa usitata*. This product is used in Burma for woodwork, to render cloth or paper waterproof (as in the manufacture of Burmese umbrellas), and to cover various articles of wood or basketware. Several kinds are recognized. Thitsi is also used as a cement in making Burmese glass mosaics.

The frame or foundation of the two cabinet-offices shown in the other illustrations. The parts are held together by a mortise-and-tenon construction

Each of these cabinets contains a complete office equipment for the store-keeper or business man, or for private use

Two styles of cabinet offices, open and ready for use. Note how the doors of the left-hand cabinet fold back

Lending a Helping Hand to Gravity

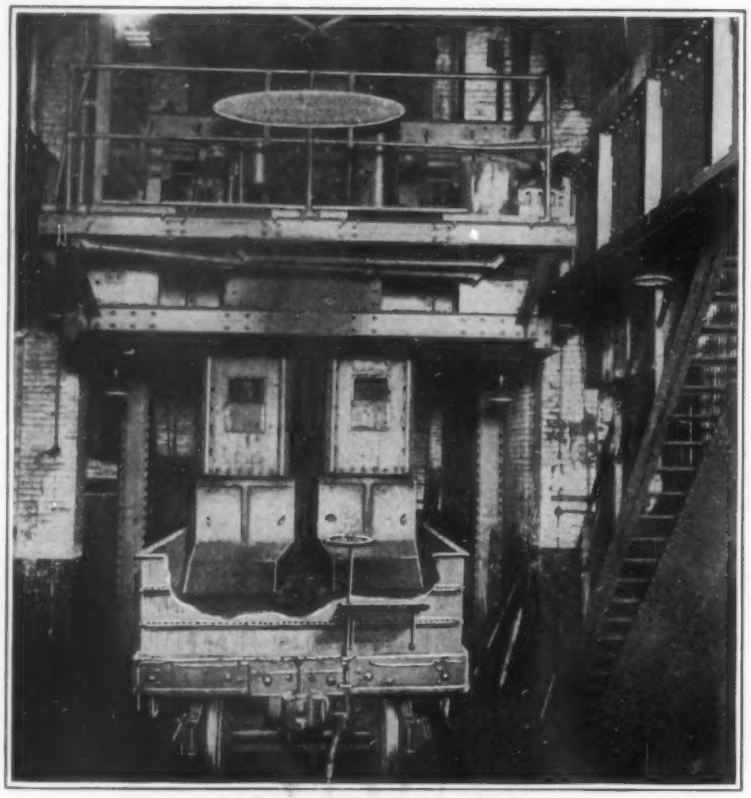
A MACHINE that unloads a 50-ton coal car in five or six minutes, by forcing the coal from the car into the track hopper, is shown in our illustration. Designed in the first place for unloading cars in which the coal had frozen, it is found valuable for general use in establishments using large quantities of coal.

Extending along both sides of the track, well overhead, a heavy girder runway is set up. The 15-ton carriage of the breaker and scraper runs on wheels which track on the top of these girders. The power from the 22-horse-power motor is not applied to these, but to pinions that mesh with the racks shown upon the inner flanges at the bottom of the girder.

The working parts consist of two huge spuds, each weighing 4½ tons and suspended by a 3,400-pound cable. In each spud, above the anvil block, is placed a double acting hammer with flexible air-hose connection. Occupying practically the entire width of the car, one or both of these spuds may be operated at a time. They are controlled by a variable speed motor, equipped with a solenoid brake and a limit device to prevent over-hoisting.

In the illustration the sides and ends of the car have been removed to show the spuds at their extreme low level, almost flush with the car floor. When the machine is idle the spuds are raised so that their lower surface is on a line with the bottom of the carriage. The bottoms of the spuds are cut away at the inner side so that they may clear the center beam of the car floor. The small amount of coal that escapes through this opening may be removed with shovels.

A car to be unloaded is placed over the track hopper and the car hopper is opened. The spuds, with their 52-horse-power motor, are able in every case to penetrate into the coal, or to start it flowing by pounding, in case it is frozen. In either event, at the proper moment the carriage is run from the end of the car up to the middle, sweeping the coal out into the hopper as it goes. It then repeats the operation from the other end, the anvil blocks having a projecting shoe on both faces for this purpose.



Mechanical unloader for coal cars

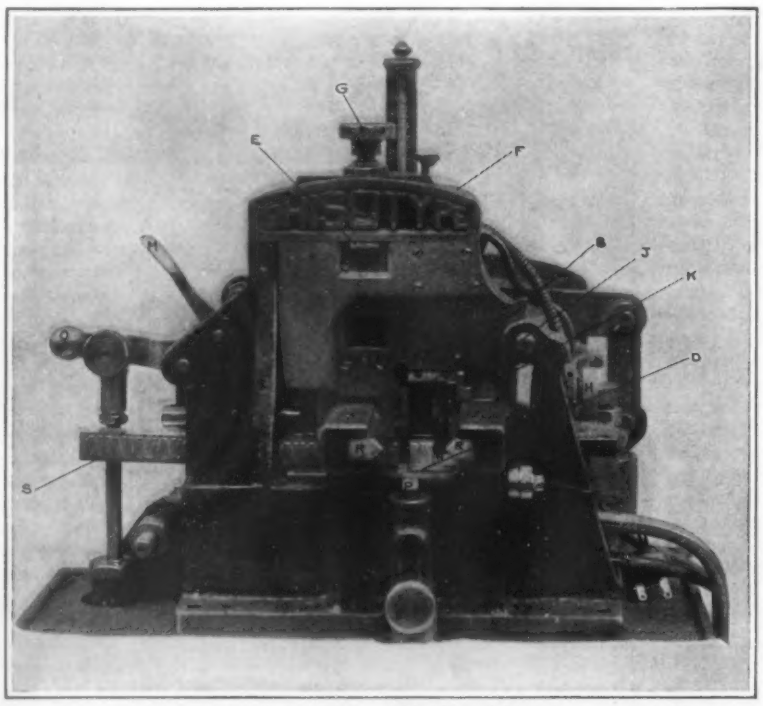
Bringing the Type-Casting Plant Within the Reach of the Small Printer

A TYPE-CASTING machine that consists of only one mold accurately adjustable to any type body from 5 to 48 points, not only to the standard point sizes but, if required, to any odd size, even to a fraction of a point, and that brings a type-casting plant within the reach of even the small job printer, so that he may have new and clean type faces at all times and at a minimum of cost, is the invention of S. A. Bishey of Bombay, India. In most type-casting machines used heretofore by printers, the mold consisted of two halves of rather intricate design, and one such complete mold was required for a letter type and one for a space type, and the cost of the set was in the neighborhood of from $60 to $100 for each body size of type. And when it is recalled that there are over twenty type bodies up to 48 point and under the old system as many sets of molds were required, it is evident that the small printer could hardly afford to install a type-casting plant.

In one of the accompanying illustrations appears the type-casting mechanism of Mr. Bishey's machine. The mold, it will be noted, is made up of four blocks, *A*, *B*, *C* and *D*, forming four sides. The block *A* is moved vertically to adjust the mold to any body size by inserting an interchangeable gage or distance piece *E*, between the top of the slide carrying the block *B* and the lower part of the mold frame *F*, and locking the same in position by means of the screw *G*. The matrix of the type is inserted in the vise formed between an abutment *J*, fixed to the mold frame and another abutment *K*, forming part of the block *B*. The block *C* is then moved toward the matrix by means of the screw *H*, until it grips the matrix and is locked in position by the lock-nut *L*. The mold is thus adjusted to the correct set width of the type corresponding to the width of the letter on the matrix. After the adjustment, the matrix is removed from the vise and placed in the matrix-holder, shown in another view. The block *B* is then moved toward the block *C*, by pressing the lever *M*, until its face comes in close contact with that of the block, *C*, and is locked in position by a lock-nut. The three sides of the mold thus adjusted to the required body and set width of the type, permanently retain their adjusted form throughout the working of the machine and consequently the parts do not rub or wear as in the case of most molds. The bottom of the mold is closed by the block *D*, during the casting, after which it moves down and carries with it the cast type opposite the platform *S*, as shown in the illustration, by means of the tang or break piece of the type having a projection locked to the surface. The pusher plate *N* then pushes the cast type from the block *D* onto the assembling platform. The block *D* moves up to close the mold ready for another casting, and slightly releases after casting by the operation of the lever *O*, to prevent any rubbing on the side of the block *D*. The mold is closed at the front by the matrix holder which moves away slightly on the rails, *R*, after casting, by the operation of the lever *P*.

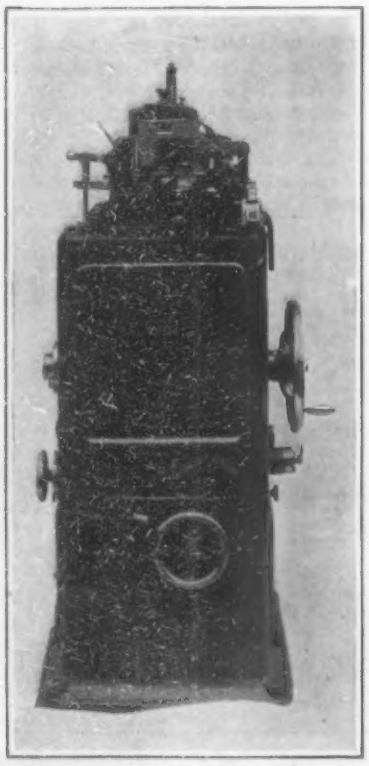
Molten metal for the type is pumped into the mold from a metal pot at the back of the mold, through a nozzle which, having no choking stem as in most other type-casting machines, allows the metal to flow freely and forcibly into the mold to ensure solid casting. While the type is packed on the platform the break piece is automatically cut, the rough edge trimmed, and any combination of two, three, or four nicks in addition to the one cast in the mold is automatically cut in the type while it is packed on the platform *S*, so that the type comes out of the machine ready for use without requiring any sub-

(*Concluded on page 430*)

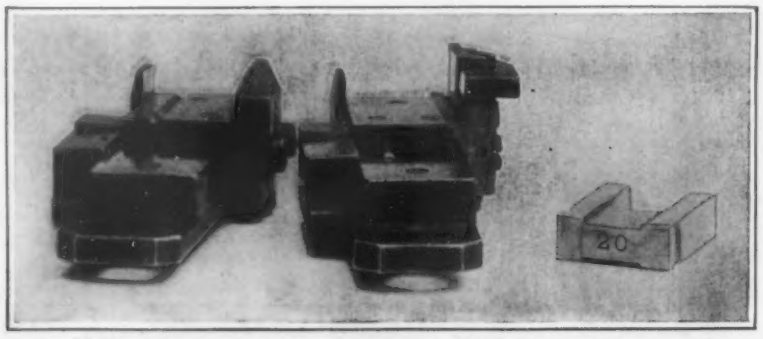


Type-casting machine invented by a Hindu, without its matrix holder

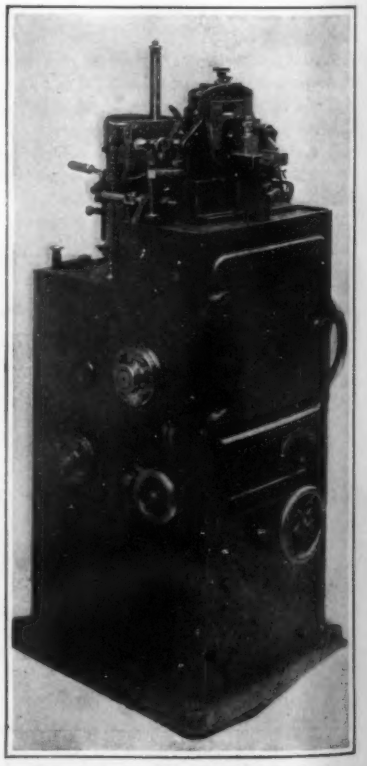
The type is shown removed from the mold after casting and resting on the block *D*, ready for packing. The finished types appear at the left of the machine, at the point *S*.



Front view of the new casting machine for the job printer



At the left: Two parts of a standard type of mold. At the right: A simple gage piece which serves to adjust the type mold of the new machine



Another view of the type-casting machine for job type

Smothering America's Bonfire

THIS burnt offering to the gods of waste and ruin is one of our great national losses. In the last twelve months it has cost the nation Two Hundred and Fifty Millions in money, and who can measure the misery?

The passing news of a distant city gutted by fire is soon forgotten. But if you were one who has stood beside the blackened heap, that a little while before was home or place of business, you would realize the grim tragedy of it. The community fire is a personal thing to each of us. Its prevention is only secured by the safeguarding of individual buildings—your property. And this is mostly a matter of choosing a roof. Roofs are the targets at which fire aims as it cuts its horrible swath. A Johns-Manville Asbestos roof checks its course, turns it back and protects the property under it. Johns-Manville Asbestos Roofing is nature's own fire repellant mineral fashioned into roofing—a type for each building, whether house, factory, barn, church, school or public building. When you decide on Johns-Manville Asbestos Roofing you have solved your problem of property protection against the roof-communicated fire. You have done your share toward the elimination of a local fire hazard. You are helping to smother the national bonfire.

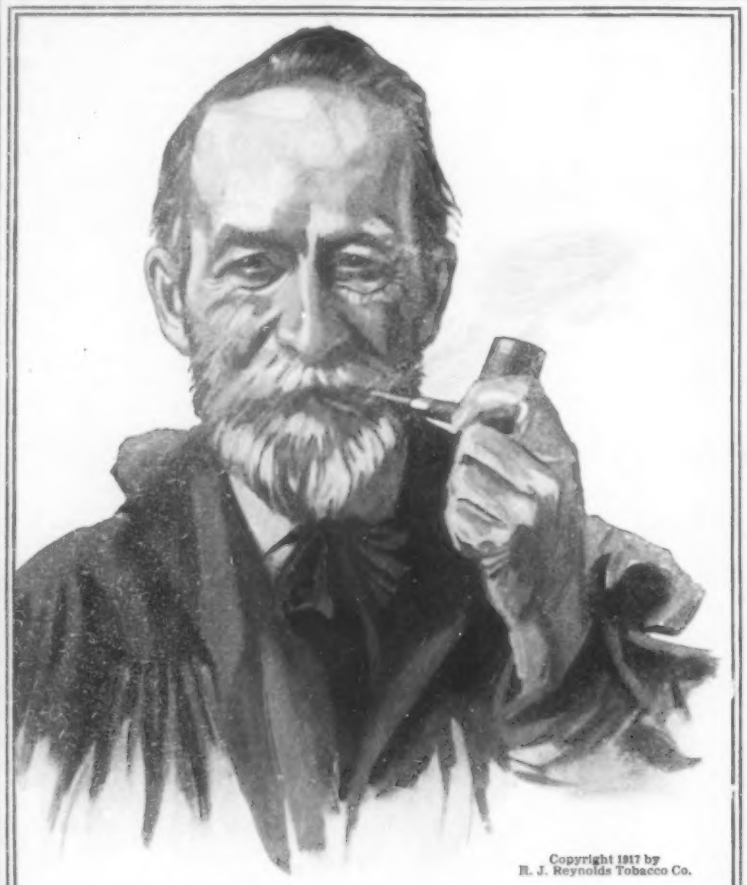
You will find your roofing in this list: Johns-Manville Asbestos Built-Up Roofing for flat roofs; Asbestos Ready Roofing for sloping surfaces; Transite Asbestos Shingles for the home; Corrugated Asbestos Roofing for skeleton frame structures.

H. W. JOHNS-MANVILLE CO.
NEW YORK CITY
10 Factories—Branches in 55 Large Cities

Johns-Manville Asbestos Roofings are examined, approved and labeled by the Underwriters' Laboratories, Inc., under the direction of the National Board of Fire Underwriters.

JOHNS-MANVILLE SERVICE COVERS THE CONTINENT

JOHNS-MANVILLE
Service in Fire Prevention



Copyright 1917 by
R. J. Reynolds Tobacco Co.

Prince Albert proves that its quality sure beats coupons a mile!

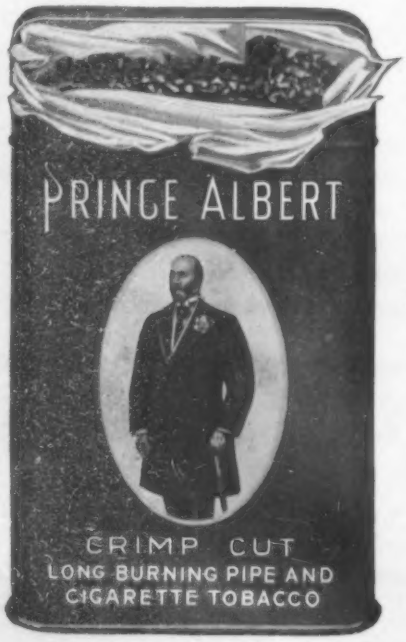
You don't have to put a tape-measure-on-your-taste to pull accurate information as to how far Prince Albert's quality-goodness *goes with you!* It z-i-p-s such joy-unlimited into jimmy pipes and home-rolled cigarettes that you slap-a-seal on your smoke-past and sprout a new spring-leaf in life's happy-days-book!

You never did bump up against such daily delight in the smoke line as Prince Albert hands out; such satisfying flavor and fragrance and *absence of bite and parch!* Bite and parch are cut out by our exclusive patented process. Cost of coupons or premiums or schemes *goes into Prince Albert quality!* That's why P. A. hits your favor so fair and square; why you can just hammer away to your *tongue's* content, firing up at a gatling-gun-gait, and always with keener anticipation for the next load.

Sure as you're reading this, your little old smokeappetite will tip-you-true that it's always smoketime when you're pals with P. A.

Make P. A. your partner and get to doing that sixty-sixty-smoke-step! Men who haven't chummed with a pipe for years come into their own in a flash via Prince Albert. Regulars adopt it like getting money out of a hunky-hole! *It's so good and friendly!* Rollers old and new have hung up their hats on the P. A. peg and called all bets off!

Everywhere tobacco is sold you can buy Prince Albert in toppy red bags, 5c; tidy red tins, 10c; handsome pound and half-pound tin humidors, and in the clever, practical pound crystal-glass humidor with sponge-moistener top that keeps the tobacco in such perfect condition, always!



Unhook yourself from pipe and "rolling" frets! Clear the decks for action and blow a real puff-party! There's more smoking joy on tap for you than you ever dreamed! We *know* how Prince Albert fits-the-fancy of smokers all over the world! We *know* how much happiness every puff will mean to you! You can't get started too soon, for it certainly does take mighty long to make up for lost time!

R. J. REYNOLDS TOBACCO CO.
Winston-Salem, N. C.

PRINCE ALBERT
the national joy smoke

Britain's Bid for the Control of the Air

(Concluded from page 423)

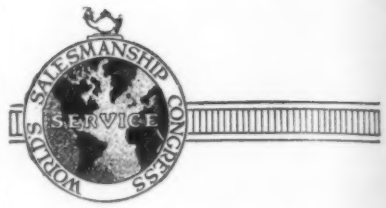
topography, the pupil is ready for service at the front. He is not required to be able to fly all the other fast types of machines, for his is a different class of service. Sometimes this type of pilot is put on a Sopwith fighting machine, which is a biplane equipped with a 135 horse-power Le Clerget engine, capable of making 125 miles an hour and carrying an observer and pilot. The pilot shoots through the propeller with a machine gun mounted in front, while the observer handles two or three machine guns mounted on a revolving rack. The latter sits on a revolving stool so that he can have a clean sweep on all sides. Aside from the Sopwith fighting machine, there are the De Haviland two-seater biplane, the Vickers Fighter, the Armstrong-Whitworth Fighter, and several other types of heavy machine, all of which are inherently stabilized so that the pilot can, practically speaking, leave the controls free while the machine flies alone.

Why the Allied Powers Have Control of the Air

The British and French have control of the air today on the Western front and they intend to keep it. Great Britain has already spent $650,000,000 on these two air services, and the present intentions are to make them two of the greatest and strongest arms of the Empire. Officers are being taken on by the thousands from all the colonies, and in the future each colony will have her own flying corps working in conjunction with the mother country. Australia, New Zealand, Canada Egypt, India and Africa will also eoöperate to form one gigantic air service. The material available for this service in the way of ideas is excellent, for the inventors of neutral and allied nations are all contributing their knowledge, while the German and Austrian machines that fall victims to the forces at the front furnish the latest data possessed by the enemy. The present invention board is composed of pilots and inventors of all the Allied nations.

It has been said that it is the intention of the British government to have one million in the army and naval wings of the flying corps. Annually, hundreds of millions of dollars will be spent in perfecting machines, aiding inventors and subsidizing plants that are manufacturing aeroplanes and aeroplane engines. The time is coming when wars will be settled in the air by great fleets of aeroplanes traveling at great heights. These fleets will bombard cities with aerial torpedoes, with guns of huge caliber, and with explosives of a powerful nature; all of which will result in disorganizing internal communications in the country attacked, and bringing the war that much nearer to an end.

If a small part of the money which has been expended on munitions of war, had been spent on the production of fighting aeroplanes similar to those in use today on the Western front, it would have been possible to organize a fleet of 200,000 machines, together with the pilots and observers. Such a fleet would have made possible the sending of a great number of bombing planes to Zeebruge and Ostend to destroy the submarines based on those ports, the dispatching of a great number for the destruction of the Krupp Arsenal which employs something like 250,000 workers, and other huge fleets to destroy means of communication in enemy territory. Perhaps the destruction of the German fleet now sheltered in the Kiel Canal would then be a possibility. At any rate, this work, together with the maintenance of numerous squadrons of aeroplanes flying close to the ground as they are doing today, moving in advance of the infantry and dropping high explosive shells into the trenches of the enemy and turning streams of machine-gun fire into trench defenders and reinforcements from a height of from 50 to 500 feet above the ground, would soon bring the present frightful war to a close. For after all, this is being done on a very small scale at the present moment; the capture of



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DETROIT JUNE 10-14

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Address .....

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Capital and Surplus
$3,900,000

the Vimy Ridge, it is said, was precipitated when the British airmen swooped down in back of the German defenders and raked their lines with machine gun fire, while the latter were too confused to fight off the airmen. So, all that I have prophesied is well within the range of possibility, given the necessary machines, engines, mechanics, pilots and other personnel.

Big British Howitzers As the Product of Woman's Handiwork

(*Concluded from page 423*)

eight and one-half days the number of 75 mm. shells which Great Britain produced during the first year of the war—August, 1914 to August, 1915, the corresponding quantity of projectiles for field-howitzers in eight days; that for medium guns and howitzers in about five days; and that of projectiles for heavy guns and howitzers in little more than one day. Three times as many 155 mm. shells, five times as many 200 mm. shells, and three times as many 230 mm. shells are being made per week as during the whole of the first year of the war. The New Projectile Factories, according to the *Illustrated London News*, turn out nearly half of the home supply of heavy shells. These buildings, placed end to end, would run to a total length of 15 miles. They contain over 10,000 machine tools driven by 17 miles of shafting. Their weekly output is over 10,000 tons of projectiles. There are two and one-half million people engaged on government munition work, including nearly a half million women. The output of new guns has also immensely increased.

To the everlasting credit of British womanhood, let it be said that the women have undertaken the most difficult machining operations on giant guns, and today they are to be found at tasks that are at once heavy and intricate. The story is told of how a woman, wishing to retain the position of her son when he joined the colors, applied herself to the work of drilling the vent-holes in the breech-mechanism of the 60-pounder howitzers—a task which is considered the most difficult of all. She had some trouble in getting the authorities to allow her to undertake the work, but her skill finally swept aside all skepticism as to her ability.

So in the torrent of steel and high-explosive which the British have been pouring into the German lines during the past few weeks there is to be found still another contribution of the women of Great Britain toward the war, a contribution which, above all others, seems destined to bring about a successful termination of the most gigantic conflict of all history.

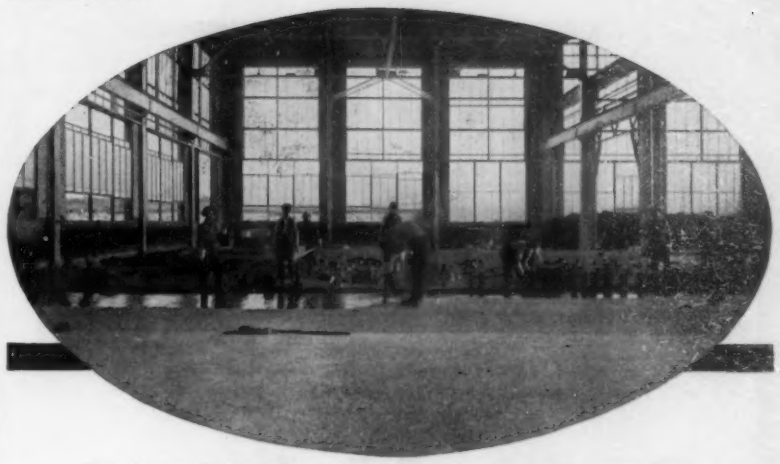
Our Mobilization of Food

(*Concluded from page 424*)

settle some definite thing to do at once. That the South can produce more food is well known and the war has brought the needed impetus. Southern farmers are determined to produce not only enough food for their own wants, but a surplus to aid in meeting the situation.

Finally, the Department is trying to bring home to the consumer the way in which he can do his bit by eliminating waste and useless buying, cooking and eating of food. In this part of the campaign women's organizations are playing an important part. Even in the case of milling methods, an appeal is made to the consumer. Too white a flour is wasteful; the breadstuff supply can be increased by eighteen millions of barrels a year through the substitution of 81 per cent milling for the present standard of 73 per cent. Liquor dealers have already signified an intention to coöperate by a decreased output with corresponding release of grain for food purposes, and the individual consumer of liquor can help out by using less.

It is pointed out by the Department that important saving of food may be effected by a diet largely vegetarian. This can be done without sacrifice of food efficiency by a partial substitution, for the more expensive meats, of beans, peas, milk and milk products, by a larger use of corn and rice as substitutes for wheat, by use of



Laying an A and L Interior Wood Block Floor. General Electric Co., Erie, Pa.

Paving the Way to Lower Maintenance Costs

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The time and wear resisting properties of floor material should be the determining factors in making your selection—not first cost.

Up-keep and renewal expense—to say nothing of reduced efficiency caused by poor condition—will quickly exceed any initial saving it's possible to make in installation.

Holding such facts to be self-evident, your selection ought to be an A and L Interior Wood Block Floors.

Adaptable to any manufacturing practice in every kind of industrial plant. Proved under the severest conditions over long periods of time to possess both strength and durability in a larger measure than any other type of floor—plus a direct and substantial contribution towards increased efficiency in men and mechanical equipment.

Write for Booklet "FLOORS"

Our Engineering Department will gladly help and advise you on any floor problem without obligation.

EXECUTIVES DIRECTORS INVESTORS
The kind and condition of the floor in the plant you are interested in has a lot to do with net earnings. It will benefit you to investigate on your own account.

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Easiest 1-Ton Truck to Handle
$350

No Service Station Needed

Ford Axles Not Cut Off

Your driver will appreciate the way in which the masterful power of the Ford engine is increased by our Special Heavy Bell Sprocket and Chain Drive.

Why this Attachment Solves the 1-Ton Truck Problem

—Capacity up to 1½ tons, operating cost 10 to 12c per mile, including housing and driver, 7½ to 9c per ton mile.
—You do not have to cut off the Ford Axle or even cut new key ways.
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Delivers more power to rear wheels—protects load—less unsprung weight—slightly slack chain relieves power plant from road shock and strain of starting and stopping.

WHY SPECIAL SPRING!
Designed by spring experts especially for the TRUCKFORD. Extra long and flexible—48"x2½". Save danger of crystallization of axles or frames from road shocks. Save the Ford engine; the load; the tires.

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Remember that no service station is needed

Eastern Truckford Co., Inc.
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A Standard Bosch Installation on the 1916 Hupmobile

Bosch Makes A Good Car Better

NATURALLY you are interested at once; for all cars but the very best leave something to be desired by the owner who knows what his car should be.

When a motor car is Bosch-Equipt it has an electrical system with a remarkable reputation for reliability and efficiency, remarkably well deserved. It is your business and essential to your satisfaction to see that your car is Bosch-Equipt.

We now supply magneto attachments for most battery equipped cars.

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Write at once for large illustrated catalog showing *complete line* of bicycles, tires and supplies, and particulars of *most marvelous offer* ever made on a bicycle. You will be astonished at our ***low prices*** and *remarkable terms.*

RIDER AGENTS Wanted —Boys, make money taking orders for Bicycles, ***Tires*** and Sundries from our big catalog. ***Do Business*** *direct* with the leading bicycle house in America. ***Do not buy*** until you ***know*** what we can do.

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Discard Toothed Gears

In all machinery where quick starts and sudden stops are essential, fibre friction transmissions are displacing toothed gears. They show higher efficiency, avoid liability of breakage from sudden shocks; practically noiseless. Cost is less, repairs cheaper and less frequent.

We make any size and type of friction to fit your requirements. If you have a transmission problem, investigate the use and design of friction drives. Our book "Friction Transmission" contains data and formulae which will prove valuable to you. Sent free on request by mention of occupation and firm connection.

THE ROCKWOOD MFG. CO.

1904 English Ave., Indianapolis, Ind., U. S. A.

"Out Again, Gone Again" With Basline Autowline

You can pull your car out of a ditch or mud hole on its own power—*if* you have a Basline Autowline.

Just fasten one end to a rear wheel, take a turn of the line around the hub, and fasten other end to fence post or tree. Then start your motor and—*zingo!*—you'll be out of trouble in a second!

That's an extra use, of course, for Basline Autowline is made for *towing.* It's a length of Yellow Strand Wire Rope with patented Snaffle Hooks for attaching. The hooks *stay* hooked. Basline Autowline is light, powerful, durable, dependable. Price, east of Rockies, $4.55.

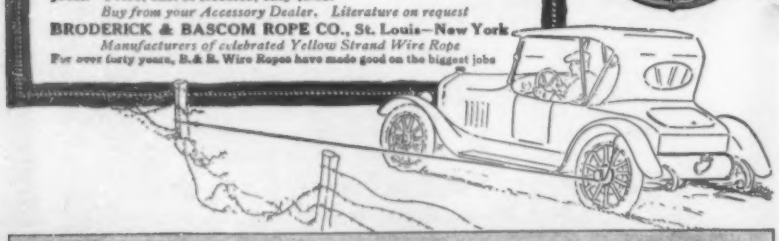
POWERSTEEL AUTOWLOCK makes your car and spare tires theft-proof. Price, east of Rockies, only $2.25.

Buy from your Accessory Dealer. Literature on request

BRODERICK & BASCOM ROPE CO., St. Louis—New York

Manufacturers of celebrated Yellow Strand Wire Rope

For over forty years, B. & B. Wire Ropes have made good on the biggest jobs



The *Original* Wire Rope Towline

home-grown and home-prepared grain products in place of more expensive commercial breakfast foods, and by increase of home storage and preservation of such foods as eggs, fruits and vegetables.

In many households serious food wastes occur through lack of knowledge. Instruction in better methods is the cure, a work for the women's clubs, although it is important that all educational agencies engage in widespread propaganda and instruction concerning economical use of foods.

That, substantially, is the situation as the Department of Agriculture sees it today. That it is meeting the emergency well is hardly to be doubted. Just how well it can handle the problems which will arise as the progress of the war makes food more and more valuable depends very largely upon the broad vision and clear sight of Congress. Without certain needed laws the Department is helpless to do more than stimulate production; with its recommendations made into law it can control, even to the point of a food dictatorship if such a course is necessary.

Meanwhile, each one who reads these lines can do his bit in food preparedness. Every one has to eat. What he eats and what he wastes in his eating is, in the long run, as important as what the farmer, the dairyman, the cattle king does, to increase production. In this way, at least, every one of us can be efficient in his labors and patriotic in his efforts to help the United States to a real mobilization of its enormous resources of fuel for the living machine.

Bringing the Type-Casting Plant Within the Reach of the Small Printer

(Concluded from page 426)

sequent operation. The mold is water-cooled on its four sides to ensure rapid working of the machine.

The mold is adjustable to cast a type of any body from 5 to 48 points by simply employing an interchangeable and inexpensive gage piece instead of a very costly set of molds or body pieces of a definite size. By the combination of two of such gages or distance pieces the mold can be accurately adjusted even to a fraction of a point, in order to match any existing type or to obtain type of any body desired.

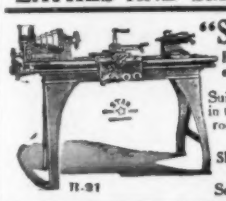
The matrix holder, which is shown at the left of the casting mechanism in the front view of the caster, is designed to use either electrotype or linotype matrices, and is provided with a micrometer head to bring the face of the matrix into alinement with that of any existing type or into any desired position on the body of the type cast.

The frame *F*, which forms the upper part of the mold, can easily be swung open on the hinge *T*, whenever required, so as readily to reach any of the parts of the mold. The various operations of the mold and machine parts are automatic in their action and controlled by only four cams inclosed in stand. The machine is driven by a small electric motor and is supplied with a mechanical speed controller enclosed in the stand, so that the speed may be easily varied to cast types of different body sizes at suitable speeds to get the best results. The machine stand occupies a floor space of 24 by 22 inches, and weighs about 900 pounds.

Mr. Bishey, the inventor of this and other type-casting machines, succeeded in winning a competitive prize in London for inventing an automatic weighing and delivering machine for ground coffee, rice, and the like, in competition with several European inventors. A complete description of this machine appeared in these columns at the time.

While the Hindu race has achieved brilliant success in science, literature and arts, it has given very little to the world in the way of inventions; in fact, the prevalent impression among the Occidental peoples has been that the Indian brain was imitative and assimilative and sadly lacked inventive faculties. Whatever may have been the opinion of the world, the work of Mr. Bishey should do much to dispel this illusion.

LATHES AND SMALL TOOLS



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OSTER

combination pipe, nipple and bolt machine.
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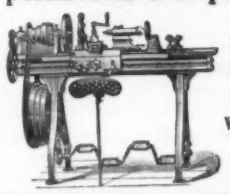
For Gunsmiths, Tool Makers, Experimental & Repair Work, etc.



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Established 1872.
1999 Ruby Street
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13 in. to 24 in. swing
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for Outrigger hoists. Faster than Elevators, and hoist direct from teams. Saves handling at less expense.
Manufactured by VOLNEY W. MASON & CO., Inc.
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The Up-to-the-Minute Novelty

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A Neat Favor for Parties. A Novelty that will amuse the whole family for an evening—A lot of Fun for 25c, prepaid anywhere in the U. S., coin or stamps, or money order.

DEALERS, Toy and Novelty Shops, Drug Stores, Cigar and News Stands, Agents, see the Counter Display Box sent to dealers prepaid in U. S. on receipt of $2.00. This dozen will sell quickly, then order more.

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287 Congress St.
Boston, Mass., - U. S. A.
Manufacturers of Specialties

Interpreting Our National Life

Facts? Yes, and something more—

Consider "The Negro," that picture of the sad, happy, lovable, tragic race—the American Peasant. Or consider "Mr. Riley," that intimate portrait of the "dear and jaunty figure of the Hoosier poet," not disdainful of sportive handsprings on the front lawn yet doughtily insistent on his right to be called "Mister" Riley.

Or "Pancho Villa," and "Browsing on the Border," full of the blazing sun of the Southwest, carrying to you a sense of that problem and that conflict which so vividly contrast our own psychology, our own complaisant democracy, with the outlook and aspirations of the Mexican.

Or "The Most Interesting American," a portrait limned with such tempered enthusiasm that the very Roosevelt strides through the pages, smiles at you (that smile!) and grips your hand. Or "What Happened in California," that brilliant analysis of men and motives which reveals that the 1916 election result—astounding to the East—is as simply explained as a child's sum.

Or "One Year Dry," a story full of human touches by a former "wet" leader, telling what the State-wide ban on booze does and doesn't do. Or "Our Challenge to Germany," that relentless arraignment of illegal submarine warfare and bugle call to America to defend the freedom of the seas.

These articles, picked at random from recent issues, are typical of those found in Collier's, week by week.

Any conscientious observer can compile *facts*. But only a writer of art and imagination can give them *life*, *truth*, *convincing power*.

Thus "The Negro" is called by a prominent colored writer "the fairest statement anent the negro, his trials, tribulations and triumphs that has ever appeared in print," a view that echoes the progressive sentiment North and South, white and black. "What Happened in California" is at once accepted by *both* parties on the Coast as the final statement. Prohibition workers everywhere call "One Year Dry" a smashing national blow for their cause.

Collier's in its handling of the war and international situation is hailed from East to West as the leader of those agencies which have awakened America to the real meaning of the war to her.

Thus Collier's is aiding the nation to develop according to the American plan—freedom and equal opportunity for all, a government for the sake of the governed. Thus Collier's is bringing to the consciousness of the American people, in their facing of world issues, the duty to the world of a nation built on these ideals.

This is another way in which Collier's earns the right to its title "The National Weekly."

This advertisement is the second of a series on the relation of Collier's to the nation

Collier's

THE NATIONAL WEEKLY

MURAD

THE TURKISH CIGARETTE

Everywhere Why?

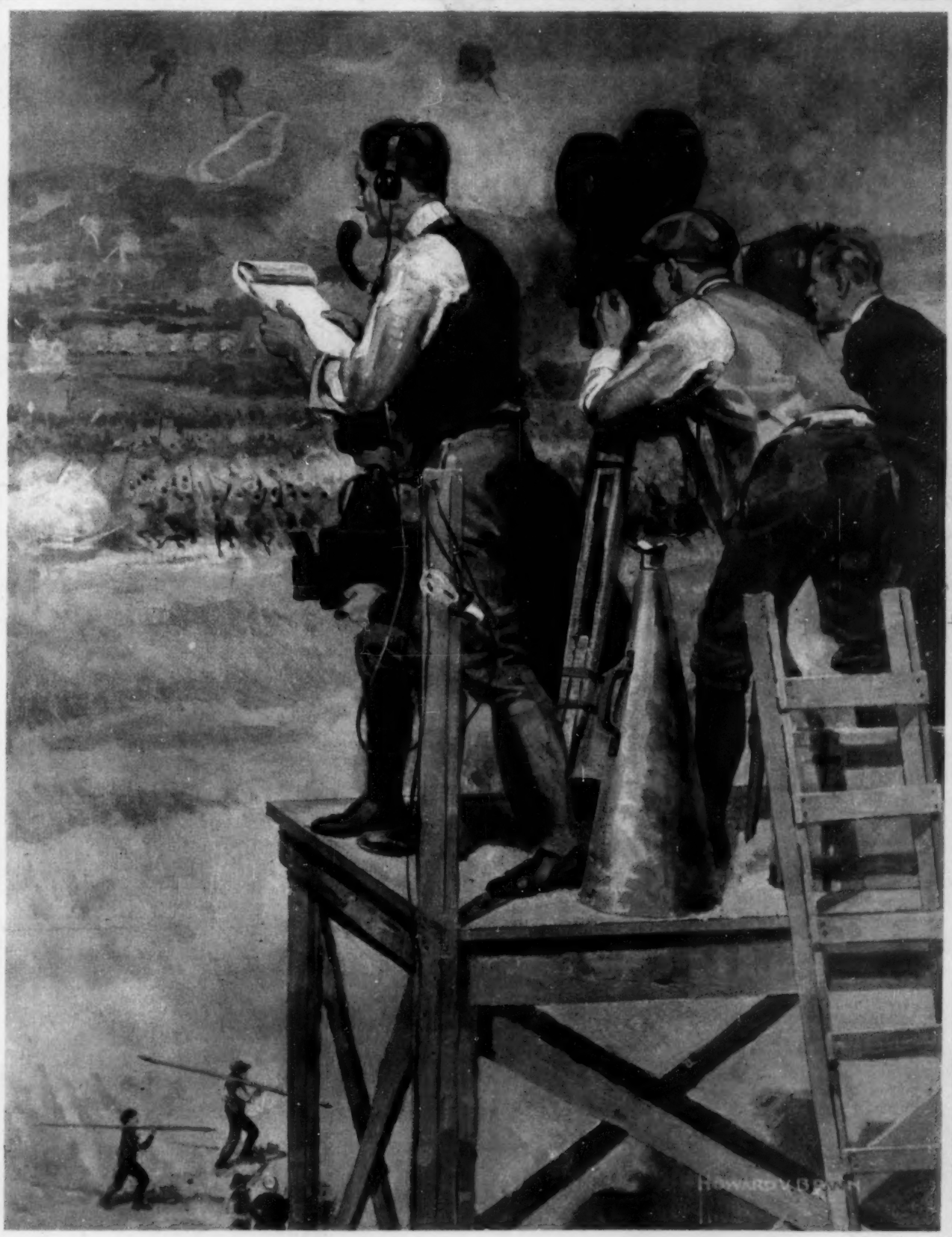
15 Cents

Anargyros
CORPORATION

Makers of the Highest Grade Turkish and Egyptian Cigarettes in the World

MAY 5 1917

SCIENTIFIC AMERICAN



DIRECTING A MOTION-PICTURE BATTLE SCENE BY TELEPHONE.—[See page 446]

May 5, 1917

Munn & Co., Inc., Publishers
New York, N. Y.

Price 15 Cents

ROLL CALL

of White Truck Fleets In Actual Service

This roll call annually becomes more truly and completely a Blue Book of American Industry and Commerce. It is a list of owners of ten or more White Trucks; showing how these fleets have grown to present size and how the rate of growth accelerates rapidly from year to year. Here is graphic evidence that the longer White Trucks are in service the more do owners become convinced of their superiority.

Fleet owners and the number of White Trucks in their service each year. The last column includes only the first three months of 1917.

OWNER	1910	1911	1912	1913	1914	1915	To-day
B. Altman & Company	0	0	8	8	33	67	92
Adams Express Company	0	0	0	2	3	5	10
American Can Company	0	0	4	7	8	8	33
American Express Company	0	0	0	7	8	8	44
American Steel & Wire Company	0	0	1	5	5	6	10
American Taxicab Company	0	0	0	0	0	0	10
American War Relief Service	0	0	0	0	0	2	35
Ammen Transportation Company	0	0	2	7	8	9	11
Anheuser-Busch Brewing Ass'n	0	0	0	0	0	1	17
Armour & Company	0	4	30	51	63	84	165
Associated Bell Telephone Cos.	0	1	6	30	46	84	311
City of Atlanta	0	3	6	8	10	10	11
Atlantic Ice & Coal Corporation	0	0	0	15	15	15	20
Atlantic Refining Company	1	4	9	31	67	86	184
Auto Livery Company	0	0	0	0	0	0	15
The Bailey Company	0	1	3	6	6	13	16
City of Baltimore	0	3	4	7	14	14	29
The Barrett Company	0	0	0	0	0	0	11
Beam-Fletcher Corporation	0	0	0	0	0	0	16
Bell Grocery Company	0	1	2	6	11	12	14
Bellevue and Allied Hospitals	0	0	0	1	3	9	15
Stedman Bent	0	0	0	0	0	0	62
William Bingham Company	0	0	0	0	0	0	16
Blake Motor Trucking Company	0	0	0	1	6	6	35
Bogge & Buhl, Inc.	0	8	10	18	23	25	25
Henry Bosch Company	2	8	8	9	10	10	11
City of Boston	0	2	9	12	17	18	25
Bradford Baking Company	0	0	0	9	20	25	26
Broadway Taxicab Company	0	3	12	12	12	12	12
Brooklyn Alcatraz Asphalt Co.	0	0	0	2	9	9	13
California Parks Transportation Co.	0	0	0	1	7	7	25
Chero-Cola Bottling Companies	0	0	0	0	4	6	30
City of Chicago	0	0	0	1	4	10	27
Chicago Fire Insurance Board	0	0	5	11	13	13	13
Clearing House Parcel Delivery Co.	0	0	0	0	0	3	10
City of Cleveland	0	2	7	14	15	19	23
Cleveland-Akron Bag Company	6	7	9	14	15	19	21
Kaufmann Department Stores, Inc.	0	0	10	16	24	44	80
Kaufmann & Baer Company	0	0	0	1	40	45	51
C. D. Kenny Company	0	0	0	0	0	0	12
Theodor Kundtz Company	3	7	8	9	10	11	12
J. William Lee & Son	0	0	0	0	0	0	13
Leyte Land Transportation Company	0	0	3	6	10	12	14
Lit Brothers	0	0	0	0	0	0	17
Los Angeles Brewing Company	0	0	2	7	13	14	15
Henry C. Lytton & Sons (The Hub)	0	6	7	9	10	11	11
McCreery & Company	6	6	8	8	8	11	17
G. M. McKelvey Company	0	0	1	1	6	8	18
R. H. Macy & Company	0	0	0	0	0	0	15
Mandel Brothers	0	9	10	15	16	17	17
State of Massachusetts	0	1	4	4	4	5	11
The May Company	0	0	0	4	11	15	26
Mesaba Transportation Company	0	0	0	0	0	2	15
Michelin Tire Company	0	1	2	3	3	9	11
National Casket Company	0	0	2	10	14	15	19
Province of New Brunswick	0	0	0	0	0	0	20
State of New York	0	0	3	3	3	5	29
City of New York	0	1	7	11	12	13	53
N. Y. Board of Fire Underwriters	0	0	2	6	8	16	20
Omaha Taxicab Company	0	0	0	0	6	8	17
Oppenheim, Collins & Company	0	0	0	0	20	21	27
Pacific Mills	0	0	3	4	4	7	12
Frank Parmelee Company	0	0	0	9	9	18	28
C. C. Parsons & Company	0	2	3	6	8	12	14
Philadelphia Electric Company	0	0	0	0	0	0	13
Pikes Peak Auto Company	0	0	0	0	0	12	15
City of Pittsburgh	0	2	9	14	14	15	15
Prest-O Lite Company	1	1	1	1	2	4	11
Public Service Corporation of N. J.	0	0	0	0	0	4	11
Pullman Taxi Service Company	0	0	0	0	10	10	31
Quaker City Cab Company	0	0	0	0	0	0	75
Riverside Taxi Service Company	0	0	0	0	5	15	15
Rocky Mountain Motors Company	0	0	2	2	3	3	22
The Rosenbaum Company	1	1	2	11	12	33	39
San Francisco Drayage Company	0	0	0	0	1	3	11
Saks & Company	0	*0	0	0	10	10	10
Cleveland Builders Supply Company	0	1	1	3	4	7	10
Cleveland Electric Illuminating Co.	0	0	0	0	0	6	17
Cleveland Provision Company	0	0	1	3	7	7	11
Cleveland & Sandusky Brewing Co.	0	0	1	1	2	3	10
Club Cab Corporation	0	0	0	0	0	21	25
Coca-Cola Bottling Companies	0	3	6	12	26	38	75
Consol. Gas, El. Light & Power Co.	2	3	6	8	11	12	12
Continental Oil Company	0	1	2	2	3	4	19
Cudahy Packing Company	0	0	2	6	8	10	21
James DeMallie	0	0	0	0	1	1	16
Dunn & Ruth	0	0	0	0	0	0	24
T. Eaton Company, Ltd.	0	5	13	14	15	15	20
William Edwards Company	0	0	0	0	0	0	10
Emerick Motor Bus Company	0	0	0	1	5	9	11
Owen H. Fay Livery Company	0	0	0	23	23	23	23
Fenway Garage Company	0	0	19	19	29	29	39
Firestone Tire & Rubber Company	0	0	1	2	3	3	14
Foster & Kleiser, Inc.	0	2	4	4	8	10	10
Frederick & Nelson, Inc.	0	0	0	3	7	9	10
A. W. Gamage, Ltd.	0	0	14	14	14	14	14
Georgia Railway & Power Company	0	0	1	3	7	7	18
Gimbel Brothers	0	20	26	46	59	59	62
Glacier Park Transportation Co.	0	0	0	0	10	20	22
B. F. Goodrich Company	4	6	9	11	12	17	19
Great Northern Paper Company	0	0	0	1	1	11	13
Greenfield Elec. Light & Power Co.	0	3	6	9	10	11	13
Gulf Refining Company	0	1	9	29	81	172	463
Halle Brothers Company	0	0	0	0	0	0	12
Hawaii County	0	0	2	9	9	9	11
H. J. Heinz Company	0	0	0	0	0	0	16
The Higbee Company	2	4	5	6	10	10	10
Hochschild, Kohn & Company	0	1	3	5	6	8	10
Joseph Horne Company	5	12	15	24	33	39	48
J. L. Hudson Company	0	0	0	0	0	10	17
Imperial Oil Company, Ltd.	0	1	1	1	1	1	12
Independent Brewing Co. of Pgh.	1	1	2	5	5	11	28
Jones Store Company	0	2	2	5	6	10	14
Schulze Baking Company	1	1	9	15	17	22	23
Seiple & Wolf	0	0	0	1	2	2	10
Franklin Simon & Company	0	0	0	3	6	10	14
W. & J. Sloane	13	14	15	15	15	17	21
Southern Express Company	0	0	0	2	9	11	31
Spear & Company	0	0	1	9	13	14	15
Standard Oil Company of California	1	3	4	6	7	26	67
Standard Oil Company of Indiana	1	4	5	9	59	122	168
Standard Oil Company of Kentucky	0	1	2	4	5	9	38
Standard Oil Company of Nebraska	0	0	0	0	5	11	17
Standard Oil Company of New York	2	6	18	35	68	113	230
Standard Oil Company of Ohio	0	1	1	1	10	17	28
Sterling & Welch Company	2	4	7	7	8	8	11
Stern Brothers	0	0	8	18	18	19	21
Stewart Taxi Service Company	0	0	0	0	0	0	18
Stroehmann Baking Company	0	0	0	2	2	2	10
Swift & Company	0	0	0	2	2	10	101
The Taxi Company	0	0	0	0	2	4	13
Taxicab Association, Inc.	0	0	0	26	40	76	176
The Taxicab Company	0	0	0	0	1	3	10
Taxicab Company of California	0	0	19	39	59	59	59
Telling-Belle Vernon Company	0	3	4	4	9	11	11
E. B. Tenny	0	0	0	1	3	6	12
Terminal Taxicab Company	0	0	20	36	61	61	61
The Texas Company	0	0	0	0	0	9	11
Union Oil Company of California	0	0	0	1	10	22	43
United Gas Improvement Company	0	0	0	0	2	3	25
United States P. O. Department	0	0	0	21	27	104	132
Wall Street Taxicab Company	0	0	0	0	0	0	14
John Wanamaker	0	0	0	0	0	6	27
Ward Baking Company	0	0	0	0	0	12	53
Raphael Weill & Company	0	0	0	0	0	10	10
Wescott Express Company	0	0	0	0	0	0	25
White Transit Company	0	1	1	2	6	9	19
State of Wisconsin	0	0	0	0	0	0	15
Yellowstone Park Trans. Company	0	0	0	0	0	0	106
Zumstein Taxicab Company	0	0	0	2	2	6	10
	54	188	459	985	1635	2473	5099

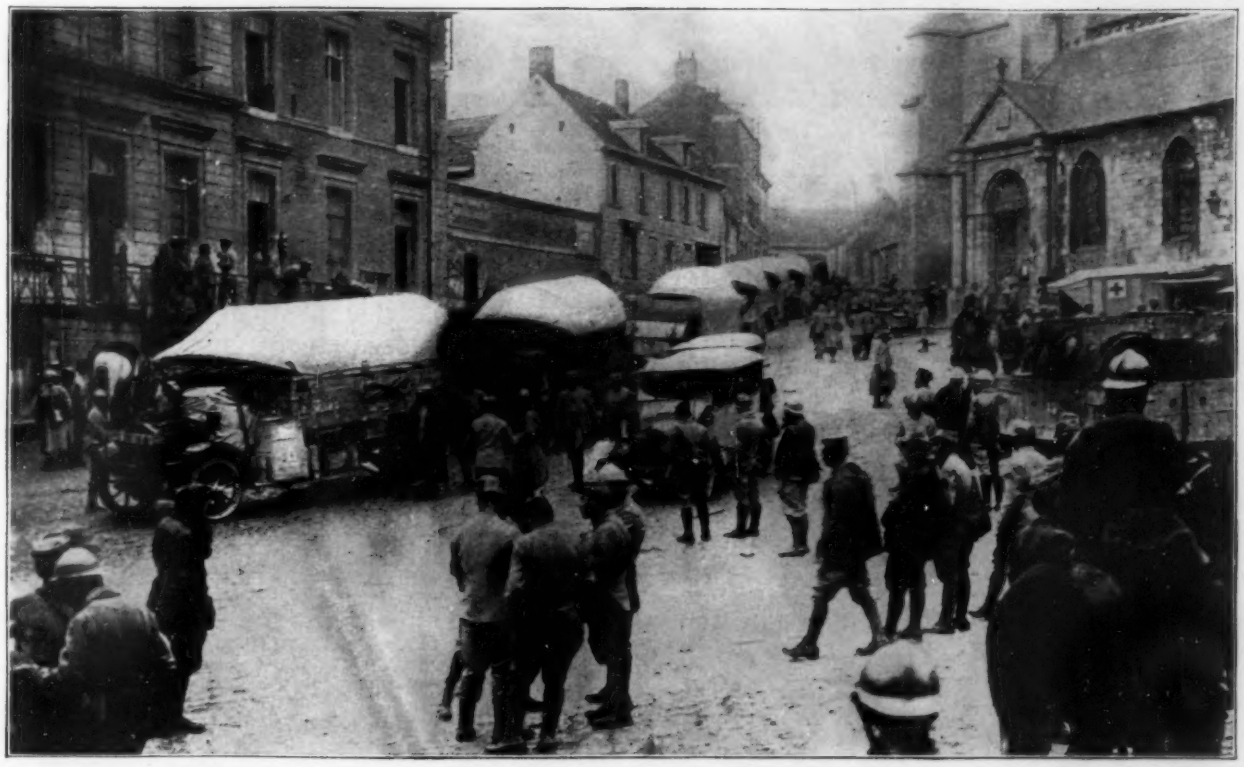
There are a total of 1695 White Truck Fleets now in service. These fleets comprise a total of 17,471 White Trucks, purchased in repeat orders over a period of years. No single truck owners included.

White Truck predominance has been consistently substantiated in White advertising year after year by publishing actual lists of White Fleet owners showing their steady growth in all lines of business.

THE WHITE COMPANY

CLEVELAND

GOODRICH
TRUCK TIRES
Stand Up Under Fire



This photograph shows a fleet of White trucks equipped with Goodrich Truck Tires on their way from Verdun to the Somme front

JUST as Verdun was saved by the timely use of motor trucks, so is the Somme front being held with the aid of great fleets of motor transports, carrying rations and ammunition over highways torn by shell fire where railroads have been put out of commission by German guns.

American-made truck tires were conceded superior to the European type by British and French motor transport experts after careful observation of all tires in actual service.

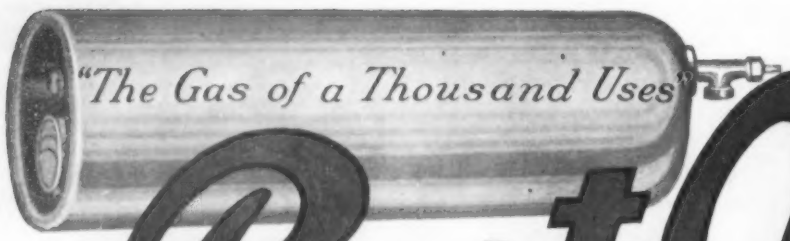
Of all the American makes, GOODRICH Truck Tires were pronounced by officials most satisfactory. They are giving the same satisfactory service in commercial work everywhere. They stand up under heavy loads on all kinds of roads just as they stand up under fire in Europe.

Specify GOODRICH in peace or war

They're Best in the Long Haul

The B. F. Goodrich Rubber Company

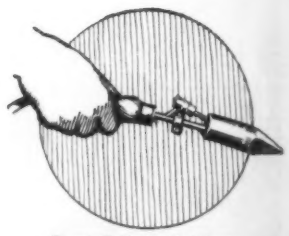
Akron, Ohio



Prest-O-Lite

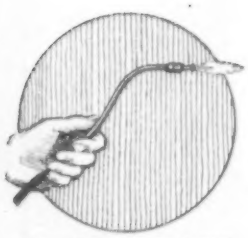
Dissolved Acetylene

(*Ready-Made Carbide Gas*)



Prest-O-Soldering Iron
Price $4.00 (Canada $5.00)

Your Prest-O-Lite has more uses, more value, than you realize



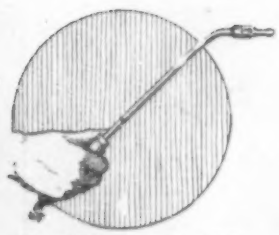
Prest-O-Torch, Style "A"
Price 75c (Canada 85c)

There are over two million Prest-O-Lites in service, a surprising number being used for commercial purposes—yet many people think of Prest-O-Lite only as an "automobile light."

Hundreds of thousands of factories, railroad shops, shipyards, mines, telegraph, telephone, gas, oil and construction companies, blacksmiths, garages, repair-shops, dentists, jewelers, electricians and others are using Prest-O-Lite for welding, soldering, brazing, lead-burning or other purposes.

If you have a Prest-O-Lite (gas tank), the appliances shown here point out a few of many ways to use it profitably.

Oxy-Acetylene Welding Apparatus



Prest-O-Torch, Style "C"
Price $2.25 (Canada $2.75)

Acetylene Blow-Torches

Quicker, cheaper and better than gasoline for soldering, brazing and heating

For all classes of soldering, brazing and heating, usually handled by the ordinary gasoline blow-torch, there is a Prest-O-Lite acetylene blow-torch which instantly provides an intense heat in a concentrated flame that does the work easily, quickly and surely. Easily turned on and off as needed.

Prest-O-Torch, Style "A"

Will braze up to 3/8-inch steel rods, 75 cents (Canada, 85 cents).

Prest-O-Torch, Style "C"

Will braze up to 2-inch solid steel bars, $2.25 (Canada, $2.75).

Prest-O-Torch, Style "D"

For dentists and jewelers

Using acetylene with or without compressed air, produces two distinct kinds of flame—a non-carbonizing *brush* flame suitable for a wide range of soldering, brazing and heating operations, or a *needle* flame suitable for infusions and casting gold, etc. The user supplies air from foot bellows, small drum or compressor. Price $3.25 (Canada, $4.45). Special Style "D" Prest-O-Torch with air trigger for quick changes from brush to needle flame, price $4.25 (Canada, $5.75).

Lead-Burning Outfit, Type "L"

Oxy-acetylene lead burning is more efficient and more economical than any other process. Operates on two gases universally obtainable—Prest-O-Lite gas and compressed oxygen. Provides a gentle needle flame ideal for lead burning; automatic pressure regulators for acetylene and oxygen cylinders, two 6-ft. lengths of hose and necessary sundries. Price, $21.00 (Canada, $30.00).

Prest-O-Soldering Iron

An easily lighted acetylene heating flame inside a copper head, saves all the trouble and inconvenience of the troublesome gasoline blow-torch and charcoal brazier for soldering on light and medium "repeat" work or the occasional small job. Simply connect to a Prest-O-Lite, turn on the gas and light. Nothing to generate, nothing to overturn, portable and economical. Price, $4.00 (Canada, $5.00).

Oxy-Acetylene Welding Apparatus

This high-grade portable welding equipment provides necessary apparatus for handling the widest range of light or heavy welding in manufacturing construction and repair work. Uses Prest-O-Lite Dissolved Acetylene and Compressed Oxygen, in convenient cylinders, ready to use.

Welding apparatus consists of an equal pressure blowpipe, automatic regulators and gages for acetylene and oxygen cylinders and the necessary sundries. Price, $75.00 (Canada, $100.00). Truck for carrying acetylene and oxygen cylinders and special apparatus for metal cutting furnished at extra cost. Our Instruction Book enables any workman who understands metals to learn welding quickly.

Prest-O-Lite Dissolved Acetylene, the purest form of carbide gas for welding, is furnished in large special cylinders on acetylene service agreement.

Acetylene Bunsen Burner

The high flame temperature of acetylene gas makes it speedy in action, and by no means an expensive fuel for Bunsen burner use in laboratories. Nothing to clean out or get out of order. Price, $1.75 (Canada, $2.25); with vessel holder, $2.00 (Canada, $2.50).

Prest-O-Lite Stem and Burner

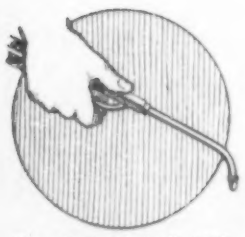
A handy light for hundreds of purposes

Attach to any Prest-O-Lite cylinder. Turn on the gas and light it. Instantly you have a handy portable light which may be used for hundreds of indoor or outdoor lighting purposes. Specify whether motorcycle or automobile size Prest-O-Lite is to be used. Price, ready to connect to cylinder, 65 cents (Canada, 75 cents).

Portable Flare Lamp

An economical light of high candle-power. May be used with a carrier for "MC" Prest-O-Lite and swung over the arm. Outfit stands 18 inches high, weighs 18 lbs. Price complete with gas cylinder, $25.00 (Canada, $30.00). Ten-inch aluminum reflector and burner only, as shown, with arm for attaching to automobile style Prest-O-Lites. Price, $12.00 (Canada, $16.50).

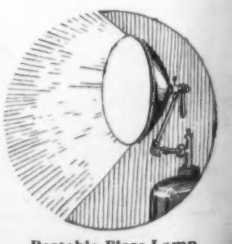
Acetylene Bunsen Burner
Price $2.00 (Canada $2.50)



Prest-O-Torch, Style "D"
Price $3.25 (Canada $4.45)

Stem and Burner
Price 65c (Canada 75c)

Lead-Burning Outfit
Type "L"



Portable Flare Lamp

Each of the pieces of apparatus shown has hundreds of profitable uses, described in full in special literature. Ask us for complete details on any use you may have in mind.

The Prest-O-Lite Co., Inc., U. S. Main Office and Factory, 849 Speedway, Indianapolis, Ind. Canadian General Office, Department O, Toronto, Ontario

55 branches and charging plants in principal industrial centers

WORLD'S LARGEST MAKERS OF DISSOLVED ACETYLENE